## SOME SUGGESTIONS ON HOW TO LIVE LONG[1]

Here are some recipes for old age deferred. I thought some of you would be glad to have them.

First: Select your ancestors. This is the best one. I am sorry is not more practicable. You are in for it personally and can't help yourself, but you may help your descendants tremendously by mating only into long-lived families. Especially, keep out of families with a history of tuberculosis and cancer. A good inheritance is certainly an immense factor in longevity, probably the greatest single factor * * *

Second: Avoid excesses. This recipe is practicable but more or less difficult, depending on the nature of one's inheritance and on his environment, that is, on his temptations. A fine ambition, hard work, and a pure love are strong safeguards. Good books and good company are other protections. Religion is another. Pitch will stick to whomsoever handles it. "Have no friends not equal to yourself," said the wise Confucius. He also said, "If a man will be virtuous one day, I have not known his strength to fail him," and by this he meant that we have to live and strive against the ape and the tiger in us *only one day at a time!*

Third: Keep cheerful, that is, don't worry. Worry kills more than work * * * Be generous, and sociable, and altruistic, as well as cheerful, and these sentiments will react upon you and make you more cheerful. I have been accused of being proud and unsociable. It is not true! Say rather: "He is shy and absorbed, and the days are not long enough!" Be of a forgiving spirit. Most of my life has been spent delving into the printed history of things, isolating or inoculating parasites, looking into culture tubes and flasks, or staring down the barrel of a microscope. It is a very laborious and exacting and at the same time a rather narrowing occupation, albeit a fascinating one. I have often said, jokingly, I would have gone into some other business if I had realized how much hard work I would have to do to get a *little* out of plant pathology.

Fourth: Cultivate the intellectual life. I believe that exercise of the intellect is an aid to longevity. How many philanthropists, statesmen, mathematicians, astronomers, physicists, chemists, geologists, physicians, and students of literature and the natural sciences have lived to be old. Their name is legion * * *

[1] Extracts from address by Dr. Erwin F. Smith, U. S. Dept. Agric., delivered at annual dinner of the Botanical Society of Washington, March 4, 1924.

Fifth: Do not neglect the physical side. Breathe pure air, night and day; eat a good variety of plain foods and not too much. Don't worry about calories and vitamins. Do some physical work each day. Golf is for rich men; sawing wood, tending furnace, hoeing in the garden, housework, and botanizing are better exercises for such as we are. Botanizing is a more wholesome exercise than straight walking, because, like golf, it brings more muscles into action, and at the same time keeps the mind interested. But straight walking is also good. How soon it dissipates a thousand gloomy fancies! Five or ten miles a day ought to keep any scientific man in trim, unless he is a glutton, in which case there is no hope for him, here or hereafter, according to Dante. You remember how low down in his *Inferno* he puts them.

Sixth: Here are some of my own habits. My first acquaintance with Dr. Osler, then a great light in the medical firmament, was made just 30 years ago * * * Osler told me he worked like the devil nine months of the year but played the other three. I have not done that, but I have taken plenty of mental recreation, if not physical. I have learned it is not good to be jabbing forever on one set of brain cells. By spurts, a few months at a time, I have worked at certain subjects very hard, often 12 to 16 hours a day or more, *i. e.*, all day and half the night, but always I have gone easily afterward for a while to recuperate, and one year with another, I have done a great deal of miscellaneous reading not directly related to my work—religious books (bibles, sermons, books of devotion, Christian, Stoic, Buddhist, Mohammedan); current literature; travels; histories, memoirs; autobiographies; letters; essays (Bacon, Montaigne, Carlyle, Emerson, and many others); poems (all sorts in half a dozen languages); plays (especially Shakespare, but a little of Ibsen and Shaw,—yes, even Shaw—also Schiller, Hugo, Racine, and Molière—I have been very fond of Molière and of Synge, the Irish playwright); ghost stories; detective stories; novels and romances (Smollet, Fielding, Scott, Dickens, Thackeray, Hardy, Dumas, Hugo, Daudet, Cooper, Hawthorne, and many others); politics; logic; philosophy (Plato, Kant, Spinoza, Schopenhauer, Comte, Herbert Spencer, William James); Greek, Roman, and Indian mythology; Egyptology; folk-lore; art criticism; general botany; entomology; archaeology; geology; astronomy; chemistry; medicine; and what not. All has been grist to my mill, with the exception of the higher mathematics, in which I have had no training. All knowledge has fascinated me. Like Browning's Grammarian, I would know all; even to the crumbs, I would eat up the feast. I read all of the 50-odd volumes of *Botanisches Centralblatt* one year. Beginning with the first article, I read all the *Atlantic Monthly* for many years, not to mention a dozen other journals. And, it is safe to say, I have read one thing nobody else in this room has read, that is, the whole of the letter C in the *Century Dictionary*, only a matter of 800 pages. This I did to get their style of writing definitions before I began my work on Mycology for the first edition

of the *Standard Dictionary*. I did it in four days and my head was in a whirl when I got through. I was never intoxicated with alcohol, but this *was a kind of intellectual drunk*, not to be commended.

The brain is a curious organ; no two subjects, I believe, bring into play quite the same set of brain cells, and by shifting interests the hard-worked cells of your specialty will have a chance to rest, otherwise, you will get neurasthenia, and especially if you worry. I have some reason to believe that the sub-division of labor in the brain is even greater than I have indicated, that is, that each language you learn involves a new set of cells and even that the past or future tense of a language does not exercise quite the same cells as the present tense. But enough of this.

Seventh: Finally, I am two persons in one, many persons in one, if I regard my ancestors. When I am sick I am a pessimist; when I am well, and that is generally, I am an optimist, and my optimism has grown upon me with advancing years until it is now perhaps a besetting sin, but I am pretty certain to die a pessimist, and that may compensate. Pessimism is due generally to bad digestion and to undue reflection on present miseries—a bad stomach is always an evil influence. Blessed is the man who can eat hard boiled eggs at midnight and sleep the sleep of the just. Yet the chances are he will not live out his span of life because some time he will presume *too much* upon his immunity. Optimism means good health, which should be the normal state of man, and still more it means altruism as opposed to egoism, and also, and especially, it means altruism as opposed to egoism, and also, and especially, it means *a far-reaching outlook*, and faith in God and in the perfectibility of humanity. In an optimistic mood I wrote the following sonnet, with which I will close. It embodies the best of my philosophy of life. In it I have blended both my pessimism and my optimism, but optimism has the final word.

AT 70

Backward I look from summit of the years
At the rugged dusty way of toil and grime,
From level distant plain of boyhood's prime,
—Way strewn with hopes, with triumphs and with tears:
And I am optimist, like him who hears
Clear voices call from higher peaks of Time's shore,
Driven by wind and waters evermore!
And *millions* make but shifting dunes and bars!
Yet I can read in every grassy sod
Divine great thoughts that sweep beyond the stars
And make me one with Him who is our God!

## HE DUG

He wanted a job and, like every one else,
  He wanted a good one, you know;
Where his clothes would not soil and his hands would keep clean,
  And the salary mustn't be low.
He asked for a pen, but they gave him a spade,
  And he half turned away with a shrug,
But he altered his mind and, seizing the spade—he dug!

He worked with a will that is bound to succeed,
  And the months and the years went along.
The way it was rough and the labor was hard,
  But his heart he kept filled with a song.
Some jeered him and sneered at the task, but he plugged
  Just as hard as he ever could plug;
Their words never seemed to disturb him a bit—as he dug.

The day came at last when they called for the spade
  And gave him a pen in its place.
The joy of achievement was sweet to his taste
  And victory shone on his face.
We can't always get what we hope for at first,
  Success cuts many queer jigs,
But one thing is sure—a man will succeed—if he digs.

LOUIS E. THAYER

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There is dry rice and water-grown rice; rice of the hills and rice of the plains. The Chinese call it "white jade beads," and say that it "benefits the breath, removes anxiety and thirst, warms the viscera, harmonizes the gases of the stomach, and causes the growth of flesh!" The thin rice-water gruel with which they break their fast each morning, is considered to "benefit the vital principle, strengthen the will, clarify the hearing and brighten the eye."—FLORENCE AYSCOUNGH. *A Chinese Mirror.*

# EDUCATION AND AGRICULTURAL PROMOTION IN JAPAN: II. JAPAN'S SYSTEM OF EDUCATION[1]

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## INTRODUCTION

Japan's educational revival dates only fifty-eight years back, when an educational officer was appointed in 1868 and various government schools were opened. In 1821 the Department of Education was established for the control of the educational affairs of the country.[2]

The department is to a large extent responsible for the present high position of Japan in the educational world. It is almost incredible that such great advance has been accomplished in so short a time, but Japan had a good foundation upon which to build a system of education when circumstances forced it to adopt Western ideas. A brief summary of the educational history of Japan before the Restoration may not be out of place in order that a proper perspective of the educational progress in Japan may be gained.[3]

## HISTORICAL

In the year 184 Chinese classics were first introduced, and in 285, scholars from Korea first came to Japan. From 607 to 900, Japan sent students regularly to China who brought back Chinese culture and civilization. From 700 to 770, the Nara Period, there was considerable interest in art and in the vernacular literature. Many books were published, among which were a number by women authors and poets. In 809 the Japanese alphabet or syllabification was invented. This was derived from simplified Chinese characters. From 1192 to 1858 marks the Feudal Period in which the military people, the *shoguns* and the *daimios*, held the stage. In this age, literature was relegated to a position secondary to martial arts and held as fit only for priests, courtiers, and other non-military classes. The centuries from 1600 to 1858 marked the Tokugawa shogunate. There was a partial revival of interest in literature and arts in this period, principally among

[1] General contribution from the College of Agriculture No. 181.

[2] The Department of Education. 1926. A general survey of education in Japan. Tokyo.

[3] The data contained in this article were obtained mainly from publications of the Department of Education, catalogues of the Imperial Universities and the Japan Year Book, supplemented with information obtained directly from members of the staffs of the above entities for the use of which full acknowledgment is hereby made.

the men. In 1853, Commodore Perry of the United States Navy opened Japan to Western influence, and in 1872 the famous Imperial Rescript on education which stated that "henceforward education shall be diffused that there may not be a village with an ignorant family nor a family with an ignorant member" was proclaimed. In this same year the French system of dividing the country into educational areas, each with a university and a corresponding larger number of lower institutions, was adopted. The adoption of this elaborate system proved rather premature, and it was modified so that in 1879, with the employment of an American educator as technical adviser to the Department of Education, American ideas were introduced; these can be discerned readily by one familiar with the American educational system.

With such an educational background it is not so surprising that Japan has progressed very rapidly. Considerable honor accrues, nevertheless, to the wise statesmen of Japan who had the breadth of mind to accept knowledge no matter where it came from, and for their wonderful ability in adapting it to the needs of the country. The edict was to seek knowledge everywhere and from anybody and Japan practices it to this day whenever it wishes to embark on any new work for which local talent is lacking.

## ELEMENTARY EDUCATION

Elementary education is compulsory in Japan in the sense that all children from six to fourteen years old who have not completed the course are required to attend school. The elementary course is of six years duration, and the period of compulsory attendance is also six years.

This compulsion works no particular hardship on the people and no complaints are heard on its account, as a matter of fact, there is a widespread feeling that the period of compulsion should be extended to eight years. The system is so effective that for the last ten years the rate of attendance has been maintained above 98 per cent, and the last few years, above 99 per cent of children of school age.

The elementary schools are widespread and are financed mainly by the cities, towns, and villages. In 1923 there were 25,373 elementary schools, thus allowing 2.8 schools to every 1000 children of school age.

The ordinary elementary schools of Japan may be considered as the equivalent of the Philippine elementary schools including primary and intermediate grades. The Philippine schools are of seven years duration instead of six, however.

There are also higher elementary schools in Japan, courses with which we have nothing in the Philippines to correspond. This course extends from two to three years beyond the ordinary elementary. These schools are really "side sprigs" of the general educational scheme in the sense that students going on for further education do not have to go through a higher

elementary school. They serve a very useful purpose, however, in extending school facilities beyond the ordinary primary grades to a large share of the population which would otherwise call its education at an end upon finishing the usual primary grades. In addition to cultural subjects one or more vocational subjects, as manual training, agriculture, commerce, domestic science, and sometimes drawing and a foreign language are taught in the higher elementary schools.

### SECONDARY EDUCATION

Japanese schools are as a rule co-educational in the elementary grades, only. In the secondary grades we see a frank division based not so much on the old idea of keeping the sexes separate but rather on the Japanese idea that woman requires a different type of education than man. The boys go from the elementary school to the middle school, which is simply an intermediate step in their long period of schooling, while the girls go to girls' high schools which are cultural and vocational in character and aim to round up and finish their education, preparing them usually for the duties of home making.

Middle Schools aim to give secondary education to boys. The course extends for five years and takes up such subjects as Japanese, Chinese classics, one foreign language (English, German, or French), history, geography, mathematics, natural history, physics and chemistry, law and economics, industry, sewing, drawing, and gymnastics. Its equivalent in the Philippine system is the high school, but is one year longer. Combining the Japanese elementary school of six years and the middle school of five years gives a duration of eleven years, which is exactly equivalent to the combined four year primary, three year intermediate, and four year school courses of the Philippines.

Boys graduating from elementary schools are theoretically eligible to enter a middle school, but in practice, due to the large number of applicants, competitive entrance examinations are held and only about 10 per cent of qualified applicants are admitted. In this one rigid selective step may be found one of the basic reasons for the high standard of Japanese higher education in government schools. There were 500 middle schools in 1925, or one to every 50 elementary schools.

In addition to the middle schools for boys and the girls' high schools, other organs of secondary education are technical schools and technical continuation schools. Both admit students who have passed the elementary courses. The technical schools correspond to our trade and agricultural schools of high school grade, and the continuation schools to night trade or occupational schools. The continuation schools take in as students boys and girls engaged in regular vocations. The technical schools are rather varied in character and may be trade, commercial, agricultural, or nautical.

## COLLEGIATE EDUCATION

This type of education is represented by the high schools of which there are twenty-five government supported. In addition, twenty-five state and private universities have preparatory schools of the same rank as the high schools.

While the original object of the high schools was to complete men's general education, at present they function almost exclusively as preparatory schools for students desiring to enter a university. The course is of three years duration and two curricula are followed, one preparing for a literary career and the other for the sciences. In addition to such general cultural subjects as history, economics, Japanese and Chinese, and natural sciences, the study of two foreign languages (English and German, or French) is made obligatory.

There is sufficient accommodation for only one-tenth the number of students in the middle schools in the high schools, so again a rigid selection becomes operative in the students who are able to enter the high schools. Theoretically, a graduate of a middle school may enter a high school on the strength of his diploma, but in practice an examination is instituted that sifts out only the best students. There is no disqualification in these examinations, and a persistent scholar may take them again and again until he qualifies. It is estimated that only about 20 per cent of applicants for admission in high schools can be accommodated every year.

The high school as found in Japan finds its counterpart in the junior college of America and the preparatory courses given to prospective students of the Colleges of Medicine and Law of the University of the Philippines. In Japan, however, this preparatory course is required not only in medicine and law, but also in all other cultural and professional courses as literature, science, economics, agriculture, engineering, veterinary, forestry, pharmacy, dentistry, etc., thus placing all learned careers on the same basis of preparation.

## UNIVERSITY EDUCATION

In Japan, university education may be classed as distinct from college education in that it is clearly superior to it. Our conception of a university is that it is a group of associated colleges. In Japan it represents a definite educational standard rather than an organization, and so we may find single specialized institutions of high grade bearing the name university; for example, there is the Osaka University of Medicine, Tokyo Agricultural University, Tokyo University of Commerce, etc. The university closely corresponds to the American senior college with stiff junior college requirements for admission.

To avoid confusion with the usual meaning attached to the word college as a department of learning in a university, the word faculty has been adopted, thus they have in a university the faculties of law, of medicine,

of agriculture, etc., as the case may be, to correspond with the college of law, medicine, or agriculture in American universities.

The professional courses in the university itself are of three years duration, except medicine which is four. At the end of the course and after passing an examination the student is granted the degree *Gakushi* in the branch of learning wherein he specialized. This degree closely corresponds with the Master's degree in America. Eleven such degrees are conferred and a prefix is used to denote the particular title granted: as, Science—*Ri*gakushi, Medicine—*I*gakushi, Engineering— *Ko*gakushi, Law—*Ho*gakushi, for Economics and Commerce—*Keizai*gakushi, Philosophy, Arts and Letters—*Bun*gakushi, Pharmacy—*Yaku*gakushi, Agriculture—*No*gakushi, Forestry —*Rin*gakushi, and Veterinary—*Jui*gakushi.

### POST-GRADUATE EDUCATION

All universities in good standing are authorized to grant the degree *Hakushi*, corresponding to the European doctorate degree, to those students who have devoted at least two years of study in the graduate school and have presented a thesis satisfactory to the University Council. Few or no courses are given to graduate students so that the whole time is practically devoted to research. Partially employed students may take four or five years to attain the same degree. The degree conferred bears the specialty in a manner similar to the Master's. For example, for Doctor of Agriculture it is *No*gaku-Hakushi, Doctor of Science *Ri*gaku-Hakushi, Doctor of Medicine *I*gaku-Hakushi, etc.

The graduate school is called *Daigaku-In* or translated literally, University Hall.

The examinations for the *gakushi* and *hakushi* degrees are for qualification or disqualification.

The bachelor's degree is normally not granted in Japan. There is provision however for high schools to carry a post-graduate course of one year beyond its normal scope of three years and to such students as graduate from this the degree of *Tokugyoshi* (Bachelor) is given.

### THE EDUCATION OF WOMEN

Mention was made of the fact that government provision for the education of women ends with the girls' high schools, and that these are to a large extent vocational in character and in standards comparable to the boys' middle schools. The demand for higher education among girls, however, is so great that some girls' high schools give post-graduate courses of two to three years duration. The standard of these courses is almost comparable to that of the boys' high schools. Certain technical schools and continuation technical schools are also open to girls.

While it is still the universal feeling that the sphere of woman does not demand intensive education as preparation, yet the lack of provision

for the higher education of women is to a large extent due to economic stringency. Educators are frank to admit that government provision is not even sufficient for boys, and if girls were taken in it would mean the further exclusion of a corresponding number of boys.

Private girls' schools of higher grade exist in Tokyo, Kyoto, and other large cities and Women's Higher Normal Schools are found in Tokyo and Nara. There is also the Women's University in Tokyo.

The two younger Imperial Universities, Tohoku and Kyushu, admit women with adequate preparation as special students. A few are taking advantage of this opportunity.

### THE EDUCATION OF TEACHERS

The training of teachers for the different grades of schools occupies an important place in the Japanese educational system. For example, each prefecture conducts a normal school for the training of elementary school teachers, while the Imperial government undertakes the training of teachers for the normal schools, middle schools, high schools, technical schools, etc. For high grade teachers, scholarships are granted tenable in the universities and higher normal schools. Students with adequate preparation are sent abroad for study in Europe and America along specialized lines of work.

### OTHER SCHOOLS

Finally, brief mention should be made of kindergarten schools, schools for deaf and blind, and correctional institutes. In 1923 there were 747 kindergartens and 78 schools for deaf and dumb and blind.

### PHYSICAL EDUCATION

With the advent of Western civilization the love for sports has been greatly stimulated in Japan. Military training is still the most important physical activity of schools. It is compulsory throughout the five years of the middle school course. Other sports of old Japan such as *judo*, or *jiujitsu*, wrestling, fencing, and archery have still many ardent followers, and are practiced considerably in secondary schools, but enthusiasm in them noticeably declines with the inroad of Western games. Baseball, which was first introduced in 1876 by American teachers at the Sapporo Agricultural College, now the Hokkaido Imperial University, is the most popular school game now and is played from the elementary schools to the universities. Other group games, such as football, basket ball, volley ball, track and field athletics are played widely and enthusiastically. Tennis has gone beyond the schools, and is played very widely by various institutions and clubs, athletic and otherwise, for recreation and exercise.

Athletics among girls is still in its inception. While each year marks an advance, yet the conservatism of the parents on this point makes progress slow. In girls' high schools a certain amount of physical education is required in the form of calisthenics, fancy steps, and figure movements.

## THE FINANCING OF EDUCATION

The whole system of Japanese education has grown from the top down in the sense that it is the government that decrees the spread and growth of education, rather than the system's being the result of the evolution of the people demanding greater educational facilities, as is most typically exemplified by England. Therefore the financing of education is largely borne by the government,. Contributions by private individuals and entities, while considerable, form a small percentage of the total expenditure.

In 1925 the central government spent as follows for education:

| | *Yen* |
|---|---|
| Elementary Education | 42,333,000 |
| Secondary Education | 1,400,000 |
| Higher Education | 55,994,000 |
| Normal Education | 6,656,000 |
| Other Education | 194,000 |
| Other Expenditures | 6,190,000 |
| Total | 112,767,000 |

An estimate of the expenditures for 1924 by local public bodies—the prefectures, cities, towns, and villages—amounts to 356,439,000 Yen.

No figures are available on the amount of private money spent on education.

The finances of government schools are kept apart from the general funds of the government. Any surplus left over from the schools' yearly appropriations goes to swell the school funds; likewise any donations or income derived from fees, sale of products, used equipment, etc. Schools are encouraged to raise endowment funds to swell their finances.

No fees are usually charged in the elementary grades. In the higher schools tuition varies; the highest, 100 yen a year, being in the Imperial Universities.

The salaries paid Japanese teachers are on the whole lower than those paid in the Philippines for equivalent service and training. This is so, largely because the cost of living in Japan was, until comparatively recent years, rather low. Furthermore, Japanese teachers hold on to traditions of the old samurai who considered themselves as above pecuniary consideration. They have, however, in addition another compensation in the form of honors, medals, and decorations for meritorious and long service.

Teachers from the elementary grades to the university, and in common with other public servants above a certain grade, are also eligible to pensions. This amounts to one third of the retiring salary after at least fifteen years of service. For every year thereafter and up to a maximum of forty years 1/150 of the salary is added. This places the maximum pension at 50 per cent of the salary at the time of retirement. The participants contribute monthly one per cent of their salary to the pension funds.

# SCLEROTIUM DISEASE OF TOMATO AND PEPPER[1]

MAXIMINO ATIENZA

WITH TWO PLATES AND ONE TEXT FIGURE

## THE DISEASE

### *Hosts, geographical distribution, and economic importance*

The *Sclerotium rolfsii* Sacc. reported by Ocfemia (1924) as causing fruit rot of tomato (*Lycopersicum esculentum* Mill.) and pepper (*Capsicum annuum* L.) is a common soil-inhabiting facultative parasite in Los Baños, Laguna, Philippine Islands. During the rainy season this fungus causes damping-off of seedlings, wilt, blight of shoots, and rots of fruits, stems, and roots of plants. *Sclerotium rolfsii* is destructive on plants which have the tendency to form a thick mat of interlacing stems and leaves over the ground. The *Sclerotium* fruit rot of tomato and pepper is common when the branches and fruits of these plants are very close to or touching the soil.

According to Stevens (1913) *Sclerotium rolfsii* Sacc. attacks a great number of plants in the southern United States. Tisdale (1921) states that *Scl. rolfsii* does great damage to germinating rice in Louisiana in the southern United States. He also states that the fungus attacks wheat (*Triticum vulgare*) and soybeans (*Glycine hispida* Maxim.) (*Glycine max* (L.) Merr.). Edson and Shapovalov (1923) report that *Sclerotium rolfsii* causes seed-piece rot, damping-off, stem rot, wilt, and blight of the Irish potato (*Solanum tuberosum* L.) in the United States.

Reinking (1918) reports that *Sclerotium* causes damping-off of seedlings and stem and root rots of peanut (*Arachis hypogaea* L.), coffee (*Coffea* spp.), gabi (*Colocasia antiquorum* Schott), soybean, sweet potato (*Ipomoea batatas* (L.) Poir), and yautia (*Xanthosoma sagittifolium* Schott) in the Philippine Islands. Pereira (1922) states that *Sclerotium* causes serious damage on Philippine rice.

In addition to host plants reported by Reinking (1918), Pereira (1922), and Ocfemia (1924) in the Philippines, *Sclerotium rolfsii* attacks sitao (*Vigna sesquipedalis* L.), patola (*Luffa cylindrica* Roem.) and (*L. acutangula* Roxb.), Jerusalem artichokes (*Helianthus tuberosus* L.), poñgapong (*Amorphophallus campanulatus* Roxb.), *Caladium* spp., sugar cane (*Saccharum officinarum* L.), avocado (*Persea americana* Mill.), and squash (*Cucurbita maxima* Duch.) and many other plants.

[1] Thesis presented for graduation, 1926, from the College of Agriculture, No. 244; Experiment Station contribution, No. 431. Prepared in the Department of Plant Pathology under the direction of Dr. G. O. Ocfemia.

The *Sclerotium* rot of pepper and tomato is usually of minor economic importance. During the wet season, however, damping-off of seedlings, wilt, and rot of stems and roots become more serious, especially in crowded plantings and where the stems and fruits of the plants touch the soil. Cases of total destruction of plants have been noted in rainy weather in poorly aërated and weedy plots in the College of Agriculture at Los Baños.

### *Description of Sclerotium infection of tomato and pepper*

*Sclerotium* infection first appears as oval, elliptical, oblong or irregular water-soaked lesions of varying sizes on fruits and stems of tomato and pepper. The fungus also attacks seedlings, causing damping-off, and stems and leaves of tomato and pepper, causing wilt (plate I, figure 2), blight, and rot. If the stems are infected, a white mass of fungous hyphae with sclerotial bodies of different ages may be seen (plate I, figure 1). A white growth of mycelium appears on infected fruits of pepper (plate II, figures 1, 2, 3 and 5) and tomato (plate II, figure 6) and on leaves. Rotting of infected parts soon follows the wilting (plate I, figures 1 and 2, and plate II, figure 4). The shrinking and blackening of the infected portions take place and these extend around the stem.

On the rotting portions of the stems a thick growth of mycelium appears in moist weather. Later, the mycelium produces sclerotial bodies (plate I, figures 1 and 2, and plate II, figures 1, 2, 3, 5, and 6).

The rotting areas on the fruits are covered with white mycelium. This mycelium gradually forms numerous sclerotial bodies (plate II, figures 1, 2, 3, 5, and 6). When the fruits and stems of tomato and pepper are completely rotted, the sclerotial bodies are left on the surface of the soil where they remain dormant, or germinate and live saprophytically until susceptible hosts and favorable environment for parasitism occur.

## CAUSAL ORGANISM

### *Taxonomy*

As has been previously noted by Ocfemia (1924), the *Sclerotium* attacking tomato and pepper in Los Baños, Laguna is *Sclerotium rolfsii* Sacc.

During the present work only the imperfect stage of the fungus was used. All results obtained from experiments to induce the fungus to produce the perfect stage by changing the conditions of the environment were negative.

### *Morphology of the tomato and pepper strains*

*Mycelium.* The tomato and pepper strains of *Sclerotium rolfsii* produce an abundance of mycelium on different media with the exception of sterilized avocado and moist bread. The mycelium is septate, vacuolate, and much branched (fig. 1a). Some branches are at right angles with the main hyphae while others are slightly at acute angles with the main axis (fig. 1a). A peculiar method of branching (fig. 1a) is exhibited by the mycelium. The

young branches are at first shown as knee-like projections, but as they grow longer they show the tendency to bend back to the main axis much like the formation of clamp connections. The cells of the mycelium of the tomato strain are 68.4–1270.8×2.88-9.36μ and those of the pepper strain 61.2–2028.6×3.24–7.56μ. The size of the cells of the tomato strain differs slightly from that of pepper but the difference is not considered of much taxonomic importance.

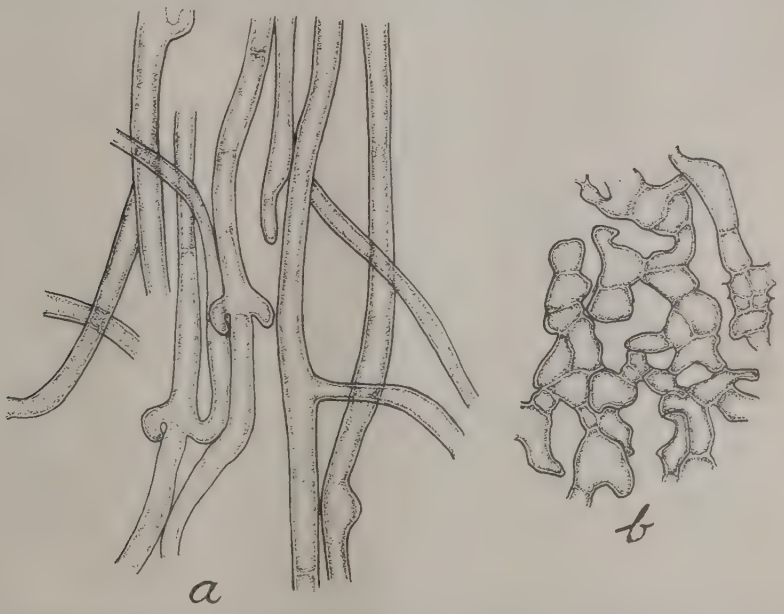


Fig. 1—(*a*) A camera lucida drawing of hyphae from a four-day-old culture with young branches bending back to the main hyphae. ×480. (*b*) A camera lucida drawing of portion of a cross section of a mature sclerotial body showing short almost oval cells and the parenchyma-like arrangement of the cells. ×480. Drawn by Mr. E. F. Roldan.

*Sclerotial bodies.* In the coarse dense masses of white mycelium in pure culture and in field materials (plate II, figures 1, 2, 3, 5 and 6) white, spherical, compact bodies are formed by the intertwining of the hyphae (fig. 1b), usually five to six days after the germination of the sclerotial bodies. These bodies are very small at first but they grow in size very rapidly and turn light to dark brown, becoming smooth and shiny with age. As soon as the sclerotial bodies begin to form, the rate of growth of the mycelium becomes slower. When the sclerotial bodies are mature, the mycelium ceases to grow.

Measurements of 100 sclerotial bodies of both strains from pure culture showed that the sclerotial bodies of the tomato strain vary in diameter

from 0.75–2.27 millimeters on corn meal, 0.69–1.48 on potato-dextrose agar, and 0.39–0.86 on the host plants. Those of the pepper strain range from 0.54–1.35 millimeters on potato-dextrose agar, 0.82–2.2 on corn meal, and 0.29–0.92 on the host plants. The sclerotial bodies of the tomato strain differ slightly in size from those of the pepper strain. On account of the extreme variability in the size of the sclerotial bodies and cells of different strains, due, perhaps, to differences of conditions or to some other unknown causes, the discrepancies in measurements are not considered a sufficient reason for separating the two strains of *Sclerotium rolfsii* into two distinct species.

*Growth of the tomato and pepper strains on various agars and sterilized plant tissues*

The growth of the fungus was studied on various media and sterilized plant tissues in the laboratory. Daily observations were made for a period of three weeks and then weekly for two months. Corn meal, potato-dextrose agar, cassava (*Manihot utilissima* Pohl.), camote, and bread were found to be good media for both strains of *Sclerotium rolfsii*. Fairly abundant growth was noted on fruits of pepper and tomato. On sterilized avocado, mango, and eggplant stems the growth was poor. The sclerotial bodies began to form when the cultures were four to nine days old. In general, the size of the sclerotial bodies of both strains did not vary on the media used, save on those on which the growth was poor. On media less suited to the fungus, the sclerotial bodies were slightly smaller than those on which the growth was luxuriant. As no noteworthy variations on the different media and sterilized plant tissues were noted in cultural studies, a detailed discussion of the results is not given.

*Pathogenicity*

*Inoculation experiments.* Mature plants of tomato, pepper, soybean, velvet bean, peanut, and eggplant in the field were inoculated with portions of mycelium or sclerotial bodies. Before inoculation, the portions to be used were disinfected with 1:1000 mercuric chloride solution and then washed with sterile water. Slits were made at the base of the plants with a flamed scalpel. Mycelium or sclerotial bodies of the fungus was inserted into the slits. The inoculated parts were covered with moist cotton to protect the fungus from drying. Control plants were prepared in exactly the same manner except that no fungous material was added.

The results of the experiments showed that infection of all plants through wounds starts on the third day. At first the progress of infection was slow, but, later, the lesions increased in size rapidly until the whole stem was infected. Infection worked very rapidly on pepper and on tomato. The inoculated plants wilted and drooped (plate I, figures 1 and 2). The control plants remained sound throughout the experiment. Field inocula-

tions on unwounded plants have given identical results although the incubation period was two to several days longer.

In the laboratory, inoculation experiments on seedlings and mature plants of tomato, pepper, peanut, soybean, and cowpea were conducted. The plants were inoculated by placing sclerotial bodies on the soil. One half of the inoculated plants and controls were placed in the damp chamber and the other half with the corresponding controls in the laboratory. Observations on inoculated plants were made daily. The infected portions showed water-soaked lesions on the seedlings more rapidly in the damp chamber than in the laboratory. Plants in the damp chamber began to rot on the third day, those in the laboratory on the fifth day. The checks remained healthy throughout the experiment. On account of moisture relations, seedlings of pepper, tomato, peanut, cowpea, and soybean, were not as readily infected in the field as were those kept in the damp chamber. Wilting took place as soon as the fungus covered the entire stem (plate I, figures 1 and 2 and plate II, figure 4).

Fruits of watermelon (*Citrullus vulgaris* (L.) Schrad.), upo (*Lagenaria leucantha* (Lam.) Rusby), pepper, and tomato were inoculated on March 31, 1925, and left covered with bell jars on the side tables in the laboratory. Small portions of the mycelium from five-day-old cultures of both strains of *Sclerotium rolfsii* were used. The results of the experiment showed that the organism started to grow on the fruits on the day following inoculation. As the fruits began to rot, sclerotial bodies were produced in enormous numbers. Measurements of these sclerotial bodies showed that they were smaller than those produced on potato-dextrose agar in test tubes, in petri dishes, and in flasks.

In the field, fruits of pepper and tomato were inoculated. The mycelium of both strains from a five-day-old culture was used. In this inoculation it was observed that the growth of the fungus was very slow. The sclerotial bodies produced were few and smaller than those produced on the fruits in the laboratory. The result shows that surrounding conditions affect the size and abundance of the sclerotial bodies produced by *Sclerotium rolfsii* Sacc. The fruits inoculated in the laboratory and those in the field rotted after six days and fourteen days, respectively.

*Re-isolation.* In all inoculation experiments re-isolations from all the inoculated plants in the field and in the laboratory gave positive results.

### *Source of inoculum for natural infection*

During the rainy season in 1924 an abundance of sclerotial bodies was found in the crevices of dead woody host plants. Rotting avocado seeds covered with numerous sclerotial bodies were found. The writer collected rotting fruits of tomato and pepper covered with tough mats of mycelium and sclerotial bodies. Sclerotial bodies were also found on masses of white mycelium at the bases of coffee plants.

The mycelium and sclerotial bodies on host plants and in the soil in the field when plated out on potato-dextrose agar showed that sclerotial bodies are capable of growing, but the mycelium is not. The result of the plating out of the fungus shows that the mycelium of *Sclerotium rolfsii* Sacc. loses its viability under field conditions much faster than the sclerotial bodies, although the exact time in which they can remain alive was not determined in this work. At the present stage of the study it seems as though sclerotial bodies are the only source of inoculum for natural infection in the field.

*Depth of the sclerotial bodies in the soil in relation to infection*

Sclerotial bodies of the tomato and pepper strains of *Sclerotium rolfsii* were buried in sterile soil at 0.5 centimeter intervals in cans varying from 0.5 centimeter to 8.0 centimeters deep. Seedlings of pepper and tomato were grown in the infected soil, which was kept moist throughout the experiment. The results thus far obtained show that seedlings planted in soil with sclerotial bodies buried from 0.5 to 1.5 centimeters deep gave 80 per cent of infected plants. The sclerotial bodies buried deeper than 1.5 centimeters showed only 15 per cent of infection. The results obtained in this experiment seem to indicate that working out the soil mechanically will bury many of the sclerotial bodies and render them harmless to plants.

## WEATHER CONDITIONS AFFECTING THE OCCURRENCE AND PREVALENCE OF THE DISEASE

Estioko's (1924-25) weather observations in the College of Agriculture for the period from 1916 to 1923 show that the rainy season begins in June and ends about January. According to this authority the temperature during this period is low. The writer noted that infected tomato and pepper in the field was very common during the months of October, November, and December, 1924, when the soil and air were always damp. The leaves of tomato and pepper on or near the ground were infected and had sclerotial bodies and mycelium on them. Examination of wilting branches and drooping leaves of tomato and pepper showed that they were attacked by *Sclerotium rolfsii* and had white sclerotial bodies and masses of mycelium on them. Observations during the rainy season in 1924 showed that damp weather is the most favorable condition for the occurrence and prevalence in the field of the disease caused by *Sclerotium rolfsii*.

Inoculation experiments carried in the field during wet weather gave positive results earlier than inoculations made during the drier part of the year. Sclerotial bodies placed on plants in the evening were found germinated the following morning. One hundred per cent of infection was noted in all the inoculation experiments in the field during the wet season.

## CERTAIN CHEMICAL TREATMENTS OF THE SOIL AND THEIR RELATION TO THE CONTROL OF SCLEROTIUM ROLFSII

### *Effect of air-slaked lime*

Two sets of experiments were conducted to determine the effects of air-slaked lime on *Sclerotium rolfsii* in the soil. Twenty-two lots of soil, each lot containing 10,000 grams, were weighed. To each set of 11 lots, 10, 50, 100, 150, 200, 250, 300, 350, 400, 450, and 500 grams of lime were added (one of the quantities to a lot) and mixed with the soil thoroughly. In the mixture the amounts of lime varied from 0.1 to 5.0 per cent. These mixtures were placed in 22 pots each 11 constituting one set. The object of the duplicates was to secure more reliable results. One half of each pot was heavily inoculated with sclerotial bodies from pure culture on potato-dextrose agar. The inoculated soil was planted to seedlings of tomato and pepper. To find if lime had any effect upon the growth of the seedlings, each mixture was checked with a control. The results of the experiment showed that the average number of infected seedlings on soil containing below two per cent of lime was 24.2 to 76.14 per cent. Seedlings on soil containing from 2 to 3 per cent lime were slightly infected. The average infection ranged from 1.02 to 13.79 per cent. In all cases the seedlings in uninoculated soil showed a perfect and healthy growth. These experiments were repeated and the same results were obtained. From the results it appears that the addition of lime at the rate of three or more per cent by weight is beneficial for reducing the damage due to *Sclerotium rolfsii* Sacc. in seed beds.

### *Effect of copper stearate*

The effect of copper stearate[2] when mixed with the soil upon the growth of the plants and the activity of *Sclerotium rolfsii* was tested. To the known weights of soil, copper stearate powder was added in amounts to make 0.2 to 0.8 per cent by weight. One half of the lot of soil treated with the copper stearate dust was heavily inoculated with sclerotial bodies from young potato-dextrose-agar cultures in flasks. To determine the effect of the chemical upon the tomato and pepper seedlings, there was a control for every range of the chemical.

In this experiment the results obtained showed that heavy infection occurred in mixtures containing 0.2 to 0.4 per cent of copper stearate. The number of infected seedlings varied from 56.6 to 83 per cent. In mixtures containing 0.6 per cent copper stearate the average number of infected seedlings was 34 per cent.

When the copper stearate was 0.8 per cent, the activity of *Sclerotium rolfsii* was totally checked.

[2]Copper stearate was obtained from Pittsburgh Plate Glass Company, Milwaukee, Wisconsin.

In all cases the control gave 100 per cent of vigorous and uninfected seedlings. The results of the experiment showed that copper stearate applied at the rate of 0.8 per cent by weight of the soil has no effect on the growth of tomato and pepper seedlings but wholly checks the ravages of the fungus. For seed bed purposes this chemical gave results that warrant further tests.

*Effects of ground sulfur*

Two sets of experiments were conducted in the laboratory to test the effect of ground sulfur upon *Sclerotium rolfsii* in the soil. The method of treatment followed was similar to that used with the lime and copper stearate. Severe infection averaging from 65 to 90 per cent was observed in lots containing 0.33 to 1.33 per cent by weights of sulfur. The average infection on plants in lots containing from 1.66 to 2.33 per cent by weight of sulfur was from 30 to 45 per cent. In lots containing from 2.66 to 3.33 per cent sulfur by weight no infection was noted. Identical results were obtained when the experiment was repeated.

*Effect of some organic mercury compounds*

The effect of Corona 640[3] and Uspulun[4] upon *Sclerotium rolfsii* in the soil was tested in the laboratory. Aqueous solutions of 0.12½, 0.25, 0.40, 1.0 and 2.0 per cent[5] of each were used.

Thirty pots of soil were planted to seedlings of pepper and tomato. In 20 pots the soil around the base of the plants was stirred and heavily inoculated with sclerotial bodies from young cultures of *Sclerotium rolfsii* on potato-dextrose agar. The remaining 10 pots were not inoculated, they were used to determine the effect of the various strengths of the solutions on the growth of the plants. The pots were divided into 10 sets of two inoculated and one uninoculated to a set. Five sets were watered once with different concentrations of Corona 640 solution and the remaining five were moistened once with the different strengths of Uspulun solution.

In the experiment it was found that infection was from 60 to 75 per cent in pots treated with Corona 640 below 0.5 per cent concentration. The pots treated with the 0.5 per cent solution, or over, were free from infection.

In pots treated with Uspulun below 1.0 per cent the average infection was from 56 to 70 per cent. In pots treated with the 1.0 per cent solution, or over, the seedlings were free from infection. All plants in the uninoculated pots treated with different concentrations of aqueous solutions of the two

[3], [4] Trade names of the organic mercury compounds used. Corona 640 was supplied by Pittsburgh Plate Glass Company, Milwaukee, Wisconsin. Uspulun by the Bayer Company, Inc., New York.

[5] The solutions were prepared by dissolving a known weight of the powder in small amounts of tap water making the volume of the solution to 100 cc. in a graduated cylinder.

compounds were normal. The results showed that the solutions did not have any injurious effect upon the seedlings, but had controlling effect upon *Sclerotium rolfsii* in the soil when applied at certain strengths.

The experiments were repeated and identical results were obtained. Although the results are promising, no definite recommendations are given in regard to the use of these chemicals for the control of *Sclerotium rolfsii* until further experiments are carried out in the field and in the laboratory.

## SUMMARY

1. The *Sclerotium* disease of tomato and pepper due to *Sclerotium rolfsii* Sacc. is common in the College of Agriculture fields at Los Baños, Philippine Islands, during the rainy season.

2. *Sclerotium rolfsii* causes damping-off of seedlings, wilt, blights, rots of fruits and roots of tomato, pepper, and other plants.

3. On fruits of pepper and tomato the disease produces water-soaked lesions which later shrink and become covered with mycelium and sclerotial bodies. Seedlings, stems, leaves, and roots of these plants may be infected.

4. The fungus grows readily on common media and sterilized plant tissues, producing an abundance of mycelium and sclerotial bodies. The sclerotial bodies differ in abundance and in size on different media, sterilized plant tissues, and in the field. The difference is not of taxonomic significance. No spore-producing stage was noted.

5. The fungus grows from sclerotial bodies or from young hyphae. Hyphae and sclerotial bodies grow readily in moist conditions.

6. Sclerotial bodies are the chief sources of inoculum in the field. The fungus remains alive by producing sclerotial bodies. If the sclerotial bodies are buried about two centimeters in the soil they cannot infect plants. Further experiments are under way to test the effects upon the viability of the fungus of burying sclerotial bodies at different depths.

7. The disease may be controlled by sanitary measures, using chemicals, such as lime, sulfur, copper stearate, Corona 640, and Uspulun. Further experiments should be made to check the beneficial effects obtained from the addition of these compounds to the soil for the control of *Sclerotium rolfsii* in seed beds and in the field.

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## ILLUSTRATIONS

### Plate I

Fig. 1. Five-day-old inoculated pepper plants showing infection on the stems. The stems are covered with masses of fungous hyphae with small sclerotial bodies. ×⅓.

Fig. 2. Five-day-old tomato plants inoculated through soil showing infected stems covered with masses of mycelium and small sclerotial bodies. ×⅓.

### Plate II

Fig. 1. Portion of five-day-old inoculated pepper fruit showing a thick mass of coarse mycelium and developing sclerotial bodies. ×1⅓.

Fig. 2. Portion of a five-day-old inoculated pepper showing a coarse dense mass of hyphae covering the diseased portion. Sclerotial bodies are beginning to form. ×1⅓.

Fig. 3. Portion of a five-day-old inoculated pepper showing the long and coarse hyphae and developing sclerotial bodies on the rotting portion. ×1⅓.

Fig. 4. Five-day-old inoculated pepper plants showing the rotting portion of the infected stem covered with a mass of hyphæ and sclerotial bodies. ×½.

Fig. 5. Portions of a five-day-old inoculated pepper fruit showing the coarse aërial hyphae and developing sclerotial bodies. ×1⅓.

Fig. 6. Eight-day-old inoculated tomato fruit showing the dense mass of mycelium and mature sclerotial bodies. ×1½. (All photographs by the Photographic Division, Department of Agronomy, College of Agriculture, Los Baños, P. I.)

PLATE I

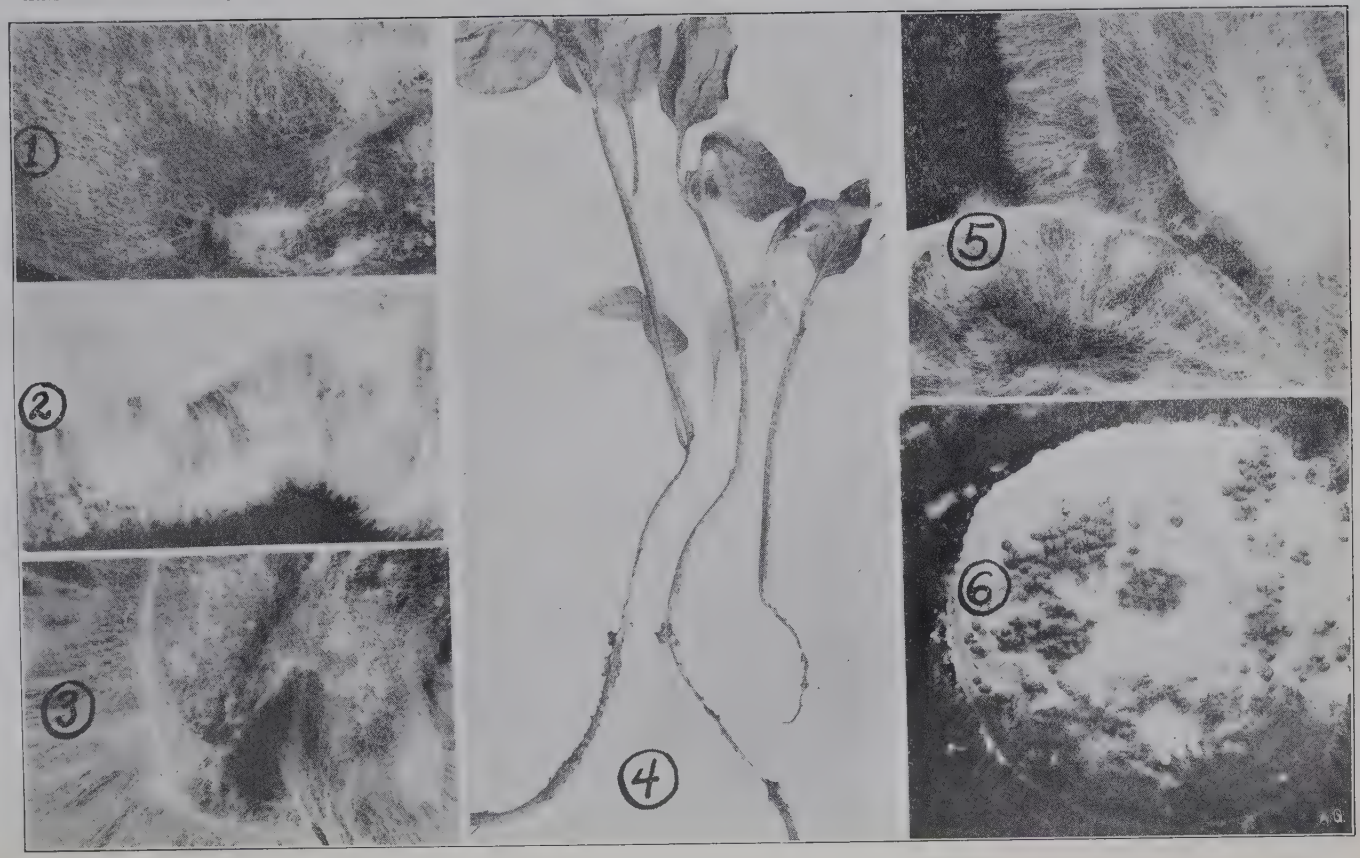


PLATE II

# A SHORT CUT METHOD FOR DETERMINING, APPROXIMATELY, PROFITS AND LOSSES IN A POULTRY PROJECT[1]

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The chicken raiser is naturally interested to know whether his poultry flock is laying a sufficient number of eggs to pay for its keep or not. The following question arises, "Is it possible for the poultry raiser to determine easily, at any given time of the year, whether or not his chickens are laying a sufficient number of eggs to pay for the cost of production?" This question may be answered in the affirmative by the poultry farmer for ordinarily he is supposed to keep careful records of all the expenses incurred in the production of eggs by his flock. This he can do, however, only after computations of the actual costs involved in the operations.

After studying the matter carefully I have come to the conclusion that it is possible to determine, approximately, by the use of a simple formula, whether the flock is laying profitably or not. This formula gives approximately what should be the percentage production of the flock, or, in other words, the number of eggs a flock of hens should produce in one day in order to cover all normal costs of production. These costs include the cost of feeds, housing, labor, depreciation, interest on the investment, hazards or risks.

## NECESSARY DATA

*Cost of a kilogram of feed.* No matter what kind and what amount of additional feed is given to the birds, this represents some cost and the value of one kilogram should be given even if only an estimate. If the feed consists of either rice or corn, or any other feed that can be obtained from the market, it is best to give the market price. If the feed consists of table and kitchen scraps, a very fair estimate can be made, which may be placed at about two centavos a kilogram, although it may be worth much more than that if the feeding value of the feed is considered. To have a definite basis for computation, the conditions as they exist in the College, in so far as they are known with certainty, are used in this paper.

[1] Experimental Station contribution No. 432. Read before the Los Baños Biological Club January 20, 1927. Received for publication February 1, 1927.

At the time of this writing, December 1, 1926, the prices of the feeds constituting the College ration were:

| | A kilogram |
|---|---|
| Corn | ₱0.067 |
| Palay | 0.093 |
| Rice bran | 0.067 |
| Copra meal | 0.067 |
| Dried shrimps | 0.217 |

The College ration consists of grain containing one part by weight of corn and palay, and mash containing four parts, by weight also, of rice bran, three of copra meal, two of corn meal, and one of dried shrimps. The grain and the mash feed are given in the proportion of one of the grain to one of the mash. At the given prices, the cost of the College ration is 8.1 centavos a kilogram.

*Cost of eggs per dozen.* The hens should be credited for all the eggs that they produce. If the eggs that the hens produce are consumed by the family, these should be given the market price in the locality. Considering that the conditions are similar to those in the College, the cost of table eggs during the period corresponding to that given above is 72 centavos a dozen. The fluctuations of the price of eggs must be considered when applying same to the formula, as it is not fair to charge 72 centavos a dozen for eggs produced in the more favorable months of the year when eggs actually are produced at a much lower cost than during the month of December.

*Feed consumption.* From the results of feeding trials carried on in this College during different years, the amount of feeds consumed by average hens varies from about twenty-eight to about thirty-one kilograms in one year. (Fronda, 1919; Taleon, 1924; Crucillo, 1926). For the sake of simplicity in the computations, the average of thirty kilograms is used. This may be considered as consisting of one-half grain and one-half mash, thus the average cost of feeds per kilogram as given above may be used at any time. This, however, does not vary much, and if it is desired, the actual amount of feeds consumed may be used. This, however, will lead only to a more complicated determination of the price of the feed.

*The factor "20".* The figure "20" that is given in the formula is an approximate factor which I have found applicable for use with ordinary flocks consisting of either Cantonese or Native fowls. It is a mathematical constant to be used in finding the desired result.

*The determination.* The formula that is used in the determinations of approximate profits or losses is as follows:

$$\frac{\text{Cost of feed per kilogram}}{\text{Cost of eggs per dozen}} \times \text{Total feed 100 hens will eat in one day} \times 20$$

By applying to this formula the figures given above, we have:

$$\frac{8.1}{72} \times \frac{3000}{365} \times 20$$

This formula, if worked out, will give 18.49 as the answer. This means that 18.49 eggs must be produced by a flock of 100 hens in one day in order that all of the expenses of production may be paid. In other words the flock must have a daily production of about 18.49 per cent.

*The cost of egg production.* In determining the actual cost of egg production, a number of items enter into the computation, the principal among which is the feed which normally represents from one-half to two-thirds of the total cost of production (Jull, *et al*, 1924). For the purposes of this paper, the average of 60 per cent is used. Taking the total cost of production as 100 per cent, the remaining 40 per cent pays for the labor, depreciation and use of buildings, equipment, the use of land, litter, the interest on the investment and the hazards of the business. In the absence of actual figures obtained under College conditions, this division of expenses has been taken for granted.

*Proof.* To prove that under the conditions given here, 18.49 eggs will be sufficient to pay the cost of production is a simple matter. If each hen consumes 30 kilograms of feed in one year, in one day, therefore, she can eat 0.0822 kilogram. At 8.1 centavos a kilogram of feed, the cost of the feeds consumed by 100 hens in one day will be $100 \times 0.0822 \times 8.1$ centavos or 66.6 centavos. If this cost of feeds represents only 60 per cent of the entire cost of production, the entire cost, therefore, will be ₱1.11, which is also the cost of 18.49 eggs at 6 centavos each or at 72 centavos a dozen.

*Results under other conditions.* In a majority of cases, especially where a definite ration is fed to the chickens, the cost of feeds per kilogram remains more or less constant throughout the year. On the other hand, the cost of eggs a dozen is more variable, depending upon the supply and demand. In this College, eggs are more expensive during the months of August, September, October, November, December, and January, than during the rest of the year. To furnish a ready guide for use as reference under any reasonable set of conditions, table 1 was prepared.

TABLE 1

*Showing the number of eggs necessary from each 100 hens a day to pay for production under different conditions*

| COST OF EGGS A DOZEN | NUMBER OF EGGS NECESSARY FROM EACH 100 HENS A DAY TO PAY FOR PRODUCTION WHEN A KILOGRAM OF FEED COSTS—IN CENTAVOS: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* |
| *centavos* | | | | | | | | | |
| 24 | 41 | 48 | 55 | 62 | 68 | 75 | 82 | 89 | 96 |
| 36 | 27 | 32 | 37 | 41 | 46 | 51 | 55 | 59 | 64 |
| 48 | 21 | 24 | 27 | 31 | 34 | 38 | 41 | 45 | 48 |
| 60 | 17 | 19 | 22 | 25 | 27 | 30 | 33 | 36 | 38 |
| 72 | 14 | 16 | 18 | 21 | 23 | 25 | 27 | 30 | 32 |
| 84 | 12 | 14 | 16 | 18 | 20 | 22 | 23 | 25 | 27 |

From table 1 it may be seen that the higher the cost of feeds given to the birds, under a given market price of eggs, the larger the number of eggs that must be produced in order to pay for production. Under the present conditions in the College, where standard eggs are sold at 72 centavos a dozen and feeds cost 8.1 centavos a kilogram, any number of eggs produced over 18.49 is net profit. Take, for instance, the conditions obtaining during the month of March when eggs sell at only 60 centavos a dozen, and the cost of feeds remain the same, an estimate on the number of eggs that should be produced may be had by referring to table 1 which gives under the column for 8 centavos on the line of 60 centavos that the number of eggs needed is roughly 22. A more exact figure may be obtained by proper application of the available data to the formula.

*Profits to be expected during the different months of the year.* A most interesting study may be made by comparing tables 1 and 2. Table 2 gives the four-year average percentage production of the Cantonese and Native breeds of fowls in the College. In the last column of this table the cost of table eggs per dozen in the College during the year 1925-1926 are given. To calculate how much profit may be expected from a flock of chickens during the different months of the year, the figures for the month in table 2 may be compared with the corresponding figures for the prices of the eggs per dozen and of the feeds per kilogram in table 1.

TABLE 2

*Giving the percentage production and price of eggs per dozen in the College of Agriculture*

| MONTHS | CANTONESE (4-YR. AVERAGE) | NATIVES (4-YR. AVERAGE) | COST OF EGGS PER DOZEN |
|---|---|---|---|
| | | | *centavos* |
| January | 30.3 | 24.2 | 72 |
| February | 35.2 | 30.9 | 60 |
| March | 33.6 | 35.2 | 60 |
| April | 32.1 | 32.6 | 60 |
| May | 28.1 | 31.2 | 60 |
| June | 27.4 | 30.3 | 60 |
| July | 25.9 | 27.6 | 60 |
| August | 20.8 | 22.6 | 72 |
| September | 24.9 | 23.1 | 72 |
| October | 22.0 | 21.7 | 72 |
| November | 23.0 | 19.6 | 72 |
| December | 18.8 | 19.2 | 72 |

As an illustration, the following conditions are assumed. Supposing Native hens are being kept, and one wishes to find the minimum number of eggs that must be produced in order to pay during the month of May. By referring to table 2, it may be found that the cost of table eggs during

this month is 60 centavos a dozen, and granting that the cost of feeds is 8 centavos per kilogram, reference is then made to table 1 where the approximate lowest limit of the number of eggs to be produced for every 100 hens may be seen to be 22. Referring to table 2, it may be seen that the normal production during this month is 31.2 eggs for every 100 hens; therefore, this represents a net gain of about 9 eggs. Whatever number of eggs is produced beyond this normal production for the month is additional net profit for the producer.

SUMMARY

A method is described for determining the approximate number of eggs that a flock of chickens should produce in order that the project will pay.

With the method given, the number of eggs that should be produced by a flock of chickens in order to gain under any given set of conditions may be roughly determined.

Knowing the normal percentage production during the different months of the year, approximate profits made or losses incurred in a poultry project may be easily computed.

This process is recommended to practical poultry raisers. Where accuracy is desired and one is willing to spend time to get it, the use of actual production costs is recommended.

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Jull, M. A., *et al.* 1924. The poultry industry. United States Department of Agriculture Separate from Yearbook: 377–456. *Fig. 1–53.*

Taleon, Alejo T. 1924. The effect of copra meal as a mash supplement for laying hens. The Philippine Agriculturist **13**: 109–113. *Chart 1.*

# THE CALORIFIC VALUE OF BAGASSE OF DIFFERENT VARIETIES OF SUGAR CANE GROWN IN THE COLLEGE OF AGRICULTURE[1]

FELIX S. SORIANO

## INTRODUCTION

The calorific value of bagasse from different varieties of sugar cane may differ within certain limits, and even in the same variety the influence of age, soil, climate, cultural treatment, etc., may cause differences in the calorific value of the so-called fiber. No studies on the heat value of bagasse of either the foreign or native canes have been made in the Philippines, although positive knowledge on the subject would be valuable and timely.

### *Review of previous work*

Many workers have studied the heat value of bagasse in comparison with that of other fuels, such as firewood, trash, and coal.

Geerligs (1909) found the calorific value, an average of Java bagasse to be 4182.6 B. T. U.[2] per pound (2323 Cal. per kgm.). But a bagasse having 46.6 per cent fiber, 4.5 per cent sucrose, 0.5 glucose, 47.5 per cent moisture and 0.9 per cent ash gave only 3868 B. T. U. per lb. (2143 Cal. per kgm.). Geerligs pointed out that the drier the bagasse, the higher is its calorific value.

Deerr (1911) also found that the higher fibered bagasse gives the best fuel value. He gives a range of difference of from 8289 (4605 Cal. per kgm.) to 8514 (4730 Cal. per kgm.) B. T. U. on dry bagasse. He attributes the difference to the varieties in the proportion of rind and pitch tissues.

Norris (1912) made a thorough investigation on the heat of combustion of bagasse from Hawaiian cane. He found that the average thermal value of dry Hawaiian bagasse is 8100 B. T. U. per lb. or (4500 Calories per kgm.) He gave the averages of six varieties of Hawaiian canes, as follows:

| | *Cal. per kgm.*[3] | *B.T.U. per lb.* |
|---|---|---|
| H69 | 4370 | 7866 |
| H27 | 4491 | 8083 |
| H20 | 4513 | 8123 |
| H239 | 4318 | 7772 |
| H355 | 4534 | 8161 |
| H349 | 4516 | 8129 |

[1] Thesis presented for graduation, 1926, with the degree of Bachelor of Science in Agriculture from the College of Agriculture No. 245; Experiment Station contribution No. 433. Prepared in the Department of Agricultural Chemistry under the direction of Professor Hilarion G. Henares.

[2] British Thermal Unit is the amount of heat required to raise the temperature of one pound of water from 62° to 63° F.

[3] 1 kgm. Cal. = 1.8 B. T. U. per lb.

Moisture plays an important part in the reduction of the fuel value of bagasse. As is well known, the higher the moisture of a sample, the less will be the amount of combustible matter per unit weight. Aside from that, the presence of water also reduces the available heat from the combustion of the bagasse, as the water absorbs heat on evaporation. The following tabulation, taken from Norris (1912), gives the amount of heat available per unit weight of bagasse corresponding to various percentages of moisture.

| *Percentage of moisture* | *Cal. per kgm.* | *Heat content B. T. U. per lb.* |
|---|---|---|
| 42 | 2610 | 4698 |
| 43 | 2562 | 4617 |
| 44 | 2517 | 4536 |
| 45 | 2473 | 4455 |
| 46 | 2428 | 4374 |
| 47 | 2383 | 4293 |
| 48 | 2338 | 4212 |
| 49 | 2293 | 4131 |
| 50 | 2248 | 4050 |
| 51 | 2203 | 3969 |

### *Object*

The object of the experiments reported in this paper was to determine the heat value of the bagasse from some cane varieties grown in the College of Agriculture.

### *Time and place of the present work*

This investigation was carried out during the first semester of the College years 1924–25 and 1925–26 in the U. P. Sugar Mill and the Chemistry Laboratory of the College of Agriculture, Los Baños, Laguna.

## MATERIALS

### *The cane varieties used*

1. A bud variant of Big Tana
2. Demerara 1135
3. Hambledon Queensland 426
4. Hawaii 20
5. Hawaii 69
6. Hawaii 27
7. Luzon White
8. Malagache
9. Mindoro Purple
10. Negros Purple
11. New Guinea 40
12. P. B. No. 42
13. Uba Cane
14. A bud variant of Luzon White
15. Tigbao Mestiza
16. Java 247
17. P. B. No. 39

### *The apparatus used*

1. Bomb calorimeter and accessories
2. Electric oven
3. Chopping machine
4. Chemical glass ware, etc.

## METHODS

Two methods were used in the determination of the calorific values: (1) By calculation from the result of proximate analysis; and (2) By actual determination of the heat of combustion by the use of a bomb calorimeter.

### *Method of sampling*

Representative samples from the sun-dried bagasse of each variety turned out during the milling season, were taken and bundled. The bagasse in the bundles were sub-sampled by cutting the large pieces into smaller ones, taking one portion of the cut pieces and chopping them in a meat chopper to a fine state of sub-division. The chopped bagasse was then put in separate bottles, one bottle for each variety.

In the case of varieties of cane not milled by the U. P. Sugar Mill, the splitting was done in the following manner: the canes were cut in the field and each variety milled separately in a small hand mill. The moist bagasse was then dried and sampled in the same way as the U. P. Sugar Mill bagasse.

### *Heat value from proximate analysis*

The methods of analysis followed in this work are:

*Moisture.* Small constant weight watch glasses were used as weighing vessels. One to 5 grams of bagasse were taken and dried for 3 hours at a time, in an electric oven at 110°C., cooled in a desiccator, then weighed. The drying was repeated until constant weight was obtained.

*Ash.* Ash was determined by weighing from 2 to 5 grams of bagasse. This was dried and then ignited to constant weight. From the weight of the residue the percentage of ash in the sample was calculated.

*Nitrogen.* The perchloric acid method was used. Samples of 1 to 3 grams each were weighed in Kjeldahl flasks and treated with 25 cc. concentrated sulfuric acid together with 2 grams of copper sulfate ($CuSO_4.5H_2O$) and 2 cc. of perchloric acid. Each sample was digested until colorless, then cooled and diluted with 250 cc. water, then treated with 100 cc. saturated sodium hydroxide, then distilled. The distillate was collected in a 250 cc. Erlenmeyer flask containing 50 cc. of standard sulfuric acid. The average of three determinations was then taken for each sample.

*Ether extract.* Ether extract was determined by weighing 2 to 5 grams of bagasse in a paper thimble. The thimble, with content, was dried to constant weight at 110°C., and then placed in the Soxhlet's ether extraction apparatus for 3 days to assure complete extraction. Then the thimble was again dried to constant weight. The difference in the constant weight before and after extraction is the ether extract.

*Crude fiber.* Crude fiber was determined by weighing about 3 grams of bagasse and digesting it with 1.25 per cent of sulfuric acid in a reflux flask for 30 minutes. The fiber was then filtered through cloth and the

residue washed with water and digested again with 1.25 per cent sodium hydroxide. This residue was again filtered and then washed with the water until it was free from alkali. The residue was put in a tared dish and dried to constant weight. It was then ignited and the difference in weight before and after ignition is the crude fiber.

*Total carbohydrates.* Total carbohydrates were determined by difference.

The calorific value was then calculated from the proximate analyses by the use of factors.[4]

### *Bomb calorimeter determinations*

Pellets of the finely chopped samples, weighing from 1 to 2 grams were made in a pellet press. These pellets were then placed in test tubes and corked tightly. In every determination the water cylinder of the calorimeter was weighed in a Cenco balance and distilled water was added to the amount of 1800 grams. The temperature of the water was kept 2 to 3°C. lower than the room temperature, by adding ice or ice cold water.

The method and technique used were essentially those suggested by Atwater and Snell (1903). The description of the bomb and its use are given in the *Journal of the American Chemical Society*, volume XXV, No. 7. For each series of determination, blank runs with sodium benzoate were made.

## RESULTS AND DISCUSSION

Table 1 gives the proximate analyses of all the varieties of bagasse examined. In column 7 are given the calculated calorific values of the moist bagasse. Columns 8 and 9 show the calculated calorific value for the dry bagasse based on the moist sample.

Table 2 shows the heat value determined by direct calorimetry, that is, by the use of bomb calorimeter.

Table 3 shows the comparison between the values calculated from proximate analyses and those determined by the bomb calorimeter. The values from proximate analyses are in all cases lower than the values determined by the bomb calorimeter, showing that there was a common cause or causes for this difference. What the causes might be were not determined. One of the causes, however, may be due to the protein content of the bagasse. The factor 4.1 for protein is used in connection with the combustion of foodstuff in the animal body where combustion is incomplete. In the calorimeter, combustion is, of course, complete and hence higher values are obtained.

It is believed that the figures obtained from direct calorimetry are more accurate than the calculated values (table 1, columns 8 and 9).

Table 3, column 2, shows that the Uba cane has 8186 B. T. U. (4548 Cal. per kgm.) the highest calorific value, and Hawaii 20, 7761 B. T. U.

[4] One gram ether extract produces 9.3 Calories and 1 gram each of proteins, crude fiber, and total carbohydrates produces 4.1 Calories.

(4312 Cal. per kgm.) the lowest. The average calorific value of all the varieties analyzed was 7976 B. T. U. (4431 Cal. per kgm.).

When making calculations on the net calorific value as obtained from the furnace, it must be remembered that the figures in table 2, columns 3 and 4 represent the highest value, as the determinations were made under room temperature in the calorific bomb where the latent heat of condensation due to combustion was included in the measurements. This heat (latent heat of condensation) is lost in actual practice, where the vapor is carried away through the chimney.

In the calculation of the real calorific value of bagasse as fuel in the furnace, the heat absorbed by the moisture in bagasse should be subtracted from the gross heat of dry bagasse. Thus Luzon White bagasse having a moisture content of 47 per cent will give a net calorific value of 3594 B. T. U. per lb. (1997 Cal. per kgm.) when burned in the furnace. This value is calculated from table 2, column 4. The calorific value of dry bagasse of Luzon White is 7,885 B. T. U. per pound. The gross heat generated in the furnace will, therefore, be $7,885 \times (1.00 - 0.47) = 7,885 \times .53 = 4,179$ B. T. U. Not all of this heat is available for generating steam in the boiler as some of it is used in converting 0.47 pound of water from room temperature to the temperature of the chimney, which in this case is around 500°F. The net heat will then be $4,179 - 0.47 [212 - 80 + 972 + 0.5 (500 - 212)] = 3,594$ B. T. U. per lb. (Norris, 1912) (1997 Cal. per kgm.), the amount of heat theoretically available for steam production.

It may be seen in table 3, columns 2 and 3, that the calorific values as determined in the bomb calorimeter show in general that high fibered bagasse has a high calorific value, hence a high fuel value. There are some varieties as Hambledon V, which has a low fiber content (31.15 per cent) as compared with Luzon White which has 39.10 per cent, but its calorific value is higher. The Hambledon V has 8026 B. T. U. per lb. (4459 Cal. per kgm.) and the Luzon White, 7885 (4318 Cal. per kgm.). Also, with the two varieties, Hambledon V and 426, there is a difference with the Hawaiian canes, H-69 having a fiber content of 33.73 per cent and H-27, 35.11 per cent fiber, but H-69 has 7905 B. T. U. per lb. (4292 Cal. per kgm.), while H–27 has 7767 B. T. U. per lb (4315 Cal. per kgm.). (See table 2, column 4.) According to Deerr (1911) these irregularities or differences which seem peculiar may be explained by the difference in the proportion of the rind and pitch tissues.

The writer found that the average calorific value of the three Hawaiian varieties used in this test; namely, H–20, H -27, and H -69 is 7878 B. T. U. per lb., or 4321 Cal. per kgm., while Norris (1912) found an average for the same variety to be 8024 B. T. U. per lb. or 4347 Cal. per kgm. This small difference may be due to the difference in age and in soil or climatic conditions.

Since some of these varieties are not grown in the Philippines on a commercial scale, it would not be justifiable to use the above average of 7976 B. T. U. (4431 Cal. per kgm.) for calculations. However, it is believed that for engineering purposes, it is safe to use 7975 B. T. U. per pound or 4430 Cal. per kgm. of dry bagasse, the average calorific value of the two most extensively grown varieties; namely, Negros Purple and Luzon White.

SUMMARY

The calorific values of bagasse of different varieties of sugar cane grown in the College have been determined.

Of the 18 varieties of sugar cane analyzed in the College of Agriculture, the Uba cane, according to the calorimetric test, showed the highest fuel value; Tigbao Mestiza and Mindoro Purple the second highest; and the Hawaiian canes, except H–69, the lowest.

Calorific value determined with a bomb calorimeter is almost invariably higher than that obtained from calculation from the proximate composition of the bagasse.

The two most popular varieties of cane grown in the Philippines, the Negros Purple and Luzon White, gave an average calorific value of 7975 B. T. U. per pound, or 4430 Cal. per kgm. on the dry basis.

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TABLE 1

*Calorific value calculated from proximate analysis*

| VARIETY | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | MOISTURE | ASH | ETHER EXTRACT | CRUDE FIBER | PROTEIN N×6.25 | TOTAL CARBOHYDRATES | CALORIFIC VALUE IN CALORIES PER KGM. | | CALORIFIC VALUE IN B.T.U. PER POUND | |
| | | | | | | | On moist sample | On dry sample | On dry sample | Crude fiber on dry bagasse |
| | *per cent* | *per cent* | *per cent* | *per cent* | *per cent* | *per cent* | | | | |
| 1. A bud variant of Big Tana | 14.48 | 3.21 | 2.33 | 31.20 | 0.76 | 51.00 | 3584 | 4190 | 7360 | 36.48 |
| 2. Demerara 1135 | 21.32 | 3.39 | 3.71 | 25.58 | 1.39 | 44.61 | 3280 | 4169 | 7505 | 32.51 |
| 3. Hambledon V | 16.54 | 2.34 | 1.44 | 26.00 | 0.67 | 53.01 | 3401 | 4075 | 7335 | 31.15 |
| 4. Hambledon 426 | 14.80 | 2.63 | 4.31 | 26.75 | 0.78 | 50.73 | 3610 | 4237 | 7625 | 31.39 |
| 5. Hawaii 20 | 17.00 | 3.11 | 6.85 | 24.60 | 1.04 | 47.40 | 3754 | 4522 | 8140 | 29.63 |
| 6. Hawaii 69 | 16.25 | 3.01 | 5.01 | 28.25 | 1.41 | 46.07 | 3571 | 4264 | 7675 | 33.73 |
| 7. Hawaii 27 | 19.86 | 2.88 | 5.14 | 28.14 | 1.14 | 42.84 | 3435 | 4282 | 7715 | 35.11 |
| 8. Luzon White | 13.23 | 3.76 | 3.56 | 33.99 | 1.22 | 44.24 | 3589 | 4138 | 7450 | 39.10 |
| 9. Malagache | 18.84 | 3.03 | 5.85 | 29.83 | 1.01 | 41.44 | 3508 | 4322 | 7780 | 36.75 |
| 10. Mindoro Purple | 17.95 | 2.95 | 7.01 | 28.36 | 0.77 | 42.96 | 3608 | 4397 | 7915 | 34.56 |
| 11. Negros Purple | 13.69 | 3.45 | 3.36 | 29.48 | 1.19 | 48.43 | 3556 | 4120 | 7416 | 34.16 |
| 12. New Guinea 40 | 17.97 | 2.46 | 7.79 | 29.12 | 1.12 | 41.54 | 3368 | 3902 | 7023 | 36.23 |
| 13. P. B. 42 | 15.59 | 3.65 | 5.65 | 26.36 | 0.99 | 47.76 | 3605 | 4271 | 7690 | 31.23 |
| 14. Uba Cane | 16.31 | 2.32 | 5.13 | 32.02 | 0.59 | 43.63 | 3603 | 4304 | 7745 | 38.79 |
| 15. A bud variant of Luzon White | 15.38 | 3.67 | 8.41 | 30.29 | 1.07 | 41.18 | 3756 | 4440 | 7990 | 35.79 |
| 16. Tigbao Mestiza | 15.88 | 2.11 | 4.53 | 34.92 | 0.83 | 41.73 | 3598 | 4277 | 7700 | 41.51 |
| 17. Java 247 | 17.85 | 2.16 | 3.14 | 33.76 | 1.51 | 41.58 | 3443 | 4191 | 7545 | 41.10 |
| 18. P. B. 39 | 17.17 | 2.72 | 1.18 | 29.15 | 0.75 | 49.03 | 3346 | 4040 | 7270 | 35.19 |
| Average | | | | | | | | 4230 | 7614 | 35.21 |

TABLE 2

*Calorific value determined by bomb calorimeter*

| VARIETY | 1 MOISTURE | 2 CALORIFIC VALUE IN CALORIES PER KGM. | 3 | 4 CALORIFIC VALUE IN B.T.U. PER POUND |
|---|---|---|---|---|
| | | On moist bagasse | Calculated on dry bagasse | Calculated on dry bagasse |
| | *per cent* | | | |
| 1. A bud variant in Big Tana | 9.42 | 3981 | 4395 | 7911 |
| 2. Demerara 1135 | 12.92 | 3800 | 4364 | 7855 |
| 3. Hambledon V | 9.11 | 4057 | 4459 | 8026 |
| 4. Hambledon 426 | 9.45 | 4028 | 4448 | 7920 |
| 5. Hawaii 20 | 8.99 | 3925 | 4312 | 7761 |
| 6. Hawaii 69 | 9.15 | 3990 | 4292 | 7905 |
| 7. Hawaii 27 | 10.01 | 3883 | 4315 | 7767 |
| 8. Luzon White | 9.43 | 3968 | 4318 | 7885 |
| 9. Malagache | 7.67 | 4070 | 4408 | 7934 |
| 10. Mindoro Purple | 7.71 | 4162 | 4510 | 8118 |
| 11. Negros Purple | 8.98 | 4079 | 4481 | 8065 |
| 12. New Guinea 40 | 9.73 | 4064 | 4502 | 8103 |
| 13. P. B. 42 | 6.94 | 4118 | 4425 | 7965 |
| 14. Uba cane | 4.95 | 4323 | 4548 | 8186 |
| 15. Bud variant of Luzon White | 5.82 | 4249 | 4512 | 8121 |
| 16. Tigbao Mestiza | 5.70 | 4263 | 4521 | 8138 |
| 17. Java 247 | 6.19 | 4198 | 4475 | 8055 |
| 18. P. B. 39 | 3.78 | 4299 | 4468 | 8042 |
| Average | | | 4431 | 7976 |

TABLE 3

*Calorific value on dry bagasse by proximate analysis and bomb determination compared*

| VARIETY | 1<br>B.T.U. PER LB. BY PROXIMATE ANALYSIS | 2<br>B.T.U. PER LB. BY BOMB CALORIMETER | 3<br>CRUDE FIBER ON DRY BAG |
|---|---|---|---|
| 1. A bud variant of Big Tana | 7360 | 7911 | 36.48 |
| 2. Demerara 1135 | 7505 | 7855 | 32.51 |
| 3. Hambledon V | 7335 | 8026 | 31.15 |
| 4. Hambledon 426 | 7625 | 7920 | 31.39 |
| 5. Hawaii 20 | 8140 | 7761 | 29.63 |
| 6. Hawaii 69 | 7675 | 7905 | 33.73 |
| 7. Hawaii 27 | 7715 | 7767 | 35.11 |
| 8. Luzon White | 7450 | 7885 | 39.10 |
| 9. Malagache | 7780 | 7934 | 36.75 |
| 10. Mindoro Purple | 7915 | 8118 | 34.56 |
| 11. Negros Purple | 7416 | 8065 | 34.16 |
| 12. New Guinea 40 | 7023 | 8103 | 36.23 |
| 13. P. B. 42 | 7690 | 7965 | 31.23 |
| 14. Uba cane | 7745 | 8186 | 38.26 |
| 15. A bud variant of Luzon White | 7990 | 8121 | 35.79 |
| 16. Tigbao Mestiza | 7700 | 8138 | 41.51 |
| 17. Java 247 | 7545 | 8055 | 41.10 |
| 18. P. B. 39 | 7270 | 8042 | 35.19 |
| Average | 7614 | 7976 | 35.21 |

# PRELIMINARY EXPERIMENTS ON THE USE OF CAMOTE (IPOMOEA BATATAS, LINN.) AS PASTURE AND AS A SOILING CROP FOR GROWING BREEDING PIGS[1]

EULOGIO RODRIGUEZ, JR., AND GEORGE KHOMSON

## INTRODUCTION

Swine can be raised satisfactorily on concentrates alone, but experiments as well as experience have shown that through the use of suitable forage and pasture crops, pork may be produced at a much lower cost than when pigs are maintained in dry lots on expensive concentrates.

Because of the benefits derived from the use of forage crops in pork production, special attention has been paid in experiment stations in the United States to studies in detail on these crops in connection with swine raising. The results obtained from these studies can serve only as general guides for hog raisers in the Philippines. It behooves us to determine, as accurately as possible, the place which each of our own forage crops may occupy on a well organized hog farm. The Department of Animal Husbandry of this College has experimented with cowpeas, sorghum, and sweet potatoes, and is now using the latter extensively for forage. It is of value to know how these and other crops may be utilized in hog feeding to the best advantage in the Philippines and to determine how far each goes to meet the ideal forage and pasture crop for hogs.

### *Review of the important literature on the subject*

Bautista (1918) states that young pigs can be raised cheaper when pastures are used with concentrates than when grain alone or pasture alone is used.

Lago (1924), in hog feeding experiments involving the use of self-feeders, observed that during the first few days the pigs consumed only a little grain as they were inclined to forage on succulent young stems, leaves, and tubers of camotes. He also observed that the pigs ate the tender tips first, then when no more could be found, the younger leaves.

Allas (1924) in his work using rice bran, corn, and copra meal as supplements to camote vines for growing pigs states that pigs relish camote, consuming both leaves and tubers.

[1] Theses presented for graduation with the degrees of Bachelor of Agriculture and Bachelor of Science in Agriculture from the College of Agriculture Nos. 246, and 247; Experiment Station contribution No. 434. Prepared in the Department of Animal Husbandry under the direction of Dr. Mariano Mondoñedo.

Henry and Morrison (1923) state that through the use of suitable forage and pasture crops, pork may be produced at much lower cost than when pigs are maintained on dry lot. They state also that pasture is especially important for growing pigs, as it keeps them thrifty.

Bell, Winchester, and Marston (1923) report that pigs on pasture make more rapid gains than pigs in a dry lot; and pigs fed a well-balanced ration in a dry lot, will not make as rapid gains as pigs on pasture fed on the same feed.

### *Objects of the work*

The objects of this work were as follows: (*a*) To determine the value of camote when used as a pasture and as a soiling crop for growing pigs on a ration consisting largely of corn, rice bran, and copra meal; (*b*) To determine the advisability of using camote as pasture or soiling.

### *Time and place of the present work*

These experiments were conducted in the Department of Animal Husbandry, College of Agriculture, Los Baños, beginning January 14, 1924, and extended to November 12, 1925.

## MATERIALS AND METHODS

### *Materials*

*The pigs.* Experiments I and II were made on twenty-six pigs, all females, from the College herd. They were all Berkshire-Jalajala grades. The pigs used in experiment III were Berkshire-Jalajala shotes.

*Feeds.* The feeds used in the different experiments consisted of corn, rice bran, and copra meal. The corn was of the Native Yellow Flint variety, and cost ₱0.085 to ₱0.088 a kilogram. Rice bran, obtained from Biñang and Cabuyao Rice Mills at ₱0.072 to ₱0.073 a kilogram, was of second-class grade, that is, a small amount of ground hulls was found mixed with the bran. Copra meal was bought from the Copra Milling Corporation, Manila, in hydraulic pressed cakes at ₱0.05 to ₱0.065 a kilogram according to the time. Dried shrimps at ₱0.23 and molasses at ₱0.02 a kilogram were used in addition to the corn, rice bran, and copra meal.

*Minerals.* In each experiment, to every 100 kilograms of the ration mixture used, one kilogram of the followig mixture was added.

*Mixture*

| | |
|---|---|
| Potassium nitrate | 10 grams |
| Sodium sulfate or magnesium sulfate | 80 grams |
| Ferrous sulfate | 10 grams |
| Corn cob charcoal | 450 grams |
| Salt | 450 grams |
| Total | 1,000 grams |

## EXPERIMENTS

### *Experiment 1*

*Object.* The object of this experiment was to determine the value of camote as a soiling crop for young breeding pigs.

*Plan.* The experiment was begun January 14, 1924, and closed April 24, 1924, covering a period of one hundred and eleven days. Twelve gilts were used. They were all yearlings and were about ready to breed.

The pigs were weighed three times within the week previous to the beginning of the experiment to determine the initial live weight. They were then divided into two lots of six pigs each; designated as lot I and lot II. The lots were as uniform as possible. Both lots were turned on grass pastures equal in size and in other conditions.

The pigs in lot I had an average initial weight of 33.02 kilograms and those in lot II, 33.13 kilograms.

Both lots were given a mixture of 60 parts rice bran, 15 parts corn, and 25 parts copra meal, with a nutritive ratio of 1:5.8. Lot I was given in addition a supply of camote vines daily, varying from two kilograms at the beginning to four kilograms at the close of the experiment. Owing to the limited supply, the pigs were never given as much camote vines as they could consume, but the amount given was maintained fairly uniform throughout the experiment. They received a total of 422 kilograms of camote vines during the period of 111 days.

*Observations.* The experiment was run for fifteen weeks and six days, or 111 days. No appreciable difference in the appetite of the pigs in the two lots was observed. Except for the difference in size and condition in favor of lot I, the pigs in the two lots did not differ greatly in appearance.

With regard to the soiling of the vines, the writers observed that the pigs fed on the tips of the vines first, then on the younger leaves, until all the leaves on the soft stem of the vines were consumed; and lastly they chewed even the hard woody portion of the vines. Allas (1924) reported similar observations.

The detailed results of the experiment are shown in table 1. It may be seen that the lot receiving camote vines as soilage gained 103 kilograms, while the pigs in the dry lot gained only 55.4 kilograms. In the soilage lot only 3.24 kilograms of grain were required for one kilogram of gain, while 6.02 kilograms were required in the dry lot, an advantage amounting to 85.8 per cent. Similarly the cost of gains in the soilage lot, without counting the cost of the vines, was considerably lower than in the dry lot, amounting to ₱0.22 a kilogram as against ₱0.42 for the dry lot pigs, a difference of ₱0.20.

TABLE 1

*Showing the computed results of experiment I*

| | LOT I | LOT II |
|---|---|---|
| | Soiling camote with corn, rice, rice bran, and copra meal | Dry lot with corn, rice bran, and copra meal |
| Number of pigs | 6 | 6 |
| Duration of the experiment | 111.00 days | 111.00 days |
| Total initial weight | 198.1 kgm. | 198.8 kgm. |
| Total final weight | 301.1 kgm. | 254.2 kgm. |
| Total gain | 103.0 kgm. | 55.4 kgm. |
| Concentrates consumed: | | |
| Corn | 49.99 kgm. | 49.99 kgm. |
| Rice bran | 199.98 kgm. | 199.98 kgm. |
| Copra meal | 83.33 kgm. | 83.33 kgm. |
| Total concentrate consumed | 333.30 kgm. | 333.30 kgm. |
| Cost of concentrate consumed: | | |
| Corn.....at ₱0.088 | ₱ 4.40 | ₱ 4.40 |
| Rice bran.....at ₱0.072 | ₱14.40 | ₱14.40 |
| Copra meal.....at ₱0.050 | ₱ 4.17 | ₱ 4.17 |
| Total cost of concentrate consumed | ₱22.97 | ₱22.97 |
| Concentrate consumed per kgm. gain | 3.24 kgm. | 6.02 kgm. |
| Concentrate consumed per 100 kgm. gain | 323.59 kgm. | 601.63 kgm. |
| Cost per kilogram gain | ₱ 0.22 | ₱ 0.42 |
| Cost of concentrate per 100 kgm. gain | ₱22.30 | ₱42.54 |
| Concentrate equivalent value of camote vines | 286.34 kgm. | ——— |
| Cash value of vines at average cost of concentrate ₱0.069 | ₱19.76 | ——— |
| Total weight of camote vine consumed | 422.00 kgm. | ——— |
| Cash value of concentrate replaced by one kgm. camote vines | ₱ 0.047 | ——— |

*Experiment II*

*Object.* The object of this experiment was to compare the value of camote as a pasture crop with common grass (*Paspalum dilatatum*) for growing breeding pigs on a ration consisting of rice bran, corn, and copra meal.

*Plan.* This experiment was started, July 15, 1924, as soon as new pastures of camote became available, and closed September 12, 1924, covering a period of 68 days.

Lot I, consisting of seven pigs, had an average initial weight of 14.20 kilograms. The pigs were placed on camote pasture. Lot II, consisting also of seven pigs, had an average initial weight of 14.23 kilograms. These pigs were turned into grass pasture. Drinking water was provided for both lots at noon. A shed sufficient to protect the pigs from the extreme heat of the sun was provided for each lot.

The pigs were turned into camote pasture A on July 15, and on August 10, when all the vines had been consumed, the pigs were moved to pasture B. It took the lot of pigs 26 days to finish camote pasture A.

Pasture B was a little better than pasture A, the stand of camote in this lot was about 50 per cent. The pigs were removed from pasture B September 18, 1924, when the camote vines were exhausted. This pasture lasted the pigs 38 days.

*Feeding.* The feeds and the method of feeding were the same as were followed in experiment I.

*Description of the pastures.* Two camote pastures were used in the experiment for lot I. The pastures were planted during the first week of January. It took one man and a bullock one and a half days to prepare and plant the two pastures. At ₱2.00 a day the cost would be ₱3.00.[2] The area of each lot was 635.56 square meters. The pasture was in a rather poor condition. The stand of camote in pasture A was estimated to be about 40 per cent, in pasture B, about 50 per cent.

*Observations.* The experiment was run for 9 weeks and 5 days, or 68 days. The experiment had to be closed at this time as there was no other camote pasture available.

The pigs in the camote pasture were observed at different times of the day. It was found that they grazed on the camote vines as well as on grass but showed a preference for the vines. This was noticed particularly in pasture A when the vines became rather scarce. When turned into pasture B the pigs showed a decided preference for camote to the grass growing between the vines. It was found also that during the first few days, early in the morning and in the afternoon before feeding, the pigs rooted considerably. During the rest of the day, they were observed to feed on the vines and root. As was noted in experiment I they fed on the tender part of the vines before the fibrous. This corroborates the observations of Lago (1924) and Allas (1924). Lago also found that during the first few days the pigs rooted considerably, but later, very little.

As the experiment progressed there was observed marked differences between the pigs in the two lots—in feeding, vigor, size, etc.

In general, judging from the appearance of the hair and skin, and from their grazing, the pigs in lot I were more vigorous and healthy than those of lot II. The lot I pigs looked larger, seemed healthier, more evenly fleshed, and thriftier than lot II pigs, which were rather lanky and spare. At the time of feeding, the pigs in lot I were more aggressive and were able to finish a meal within a shorter time than the pigs in lot II.

The results of pasturing camote are shown in table 2. Lot I gained 45.8 kilograms; lot II gained 21.3 kilograms. Lot I was 115 per cent more

[2] Computation made by Mr. José P. Esguerra, in charge of labor in the Department of Animal Husbandry.

efficient in making gains than lot II, making an average daily gain per head of 0.098 kilogram as against 0.044 kilogram for lot II.

TABLE 2

*Showing the computed results of experiment II*

| | LOT I | LOT II |
|---|---|---|
| | Camote pasture with corn, rice bran, and copra meal | Grass lot with corn, rice bran, and copra meal |
| Number of pigs | 7 | 7 |
| Duration of experiment | 68 days | 68 days |
| Total initial weight | 99.4 kgm. | 99.6 kgm. |
| Total final weight | 145.2 kgm. | 120.9 kgm. |
| Total gain | 45.8 kgm. | 21.3 kgm. |
| Concentrates consumed: | | |
| Corn | 23.55 kgm. | 23.55 kgm. |
| Rice bran | 94.20 kgm. | 94.20 kgm. |
| Copra meal | 39.25 kgm. | 39.25 kgm. |
| Total concentrates consumed | 157.00 kgm. | 157.00 kgm. |
| Cost of concentrates consumed: | | |
| Corn.....at ₱0.088 | ₱ 2.07 | ₱ 2.07 |
| Rice bran.....at ₱0.072 | ₱ 6.78 | ₱ 6.78 |
| Copra meal....at ₱0.050 | ₱ 1.96 | ₱ 1.96 |
| Total cost of feed consumed | ₱10.81 | ₱10.81 |
| Concentrate consumed per kgm. gain | 3.43 kgm. | 7.37 kgm. |
| Concentrate consumed per 100 kgm. gain | 343.00 kgm. | 737.09 kgm. |
| Cost of concentrate per kgm. gain | ₱ 0.24 | ₱ 0.51 |
| Cost of concentrate per 100 kgm. gain | ₱23.60 | ₱50.75 |
| Concentrate equivalent value of camote pasture | 180.55 kgm. | ——— |
| Cash value of camote pasture at average cost of concentrate ₱0.069 | ₱12.45 | ——— |
| Concentrate value credited to camote pasture per kgm. gain. | 3.94 kgm. | ——— |

With regard to the relative economy in gains made by the two lots, it took 3.43 kilograms of concentrates in lot I and 7.37 in lot II to make one kilogram gain. Basing calculations on the cost of concentrates, to make one kilogram gain it cost ₱0.24 in lot I and ₱0.51 in lot II. Compared with lot II, lot I made a saving of ₱0.27 worth of concentrates for every kilogram gain. In other words, the difference of 24.5 kilograms gain made between the two lots may be credited to the use of camote pasture. Since the use of camote pasture caused, directly or indirectly, the reduction of concentrates fed per kilogram gain from 7.38 kilograms in lot II to 3.43 kilograms in lot I, there is sufficient ground to credit the difference of 3.94 kilograms of concentrates saved to pasture. Had lot I been placed under feeding similar to lot II, or had lot II been fed until it gained the same

amount as lot I it would have required 337.55 kilograms of concentrates to make 45.8 kilograms gain. As it was, lot I actually required only 157 kilograms of concentrates to make the 45.8 kilograms gain, a saving of 180.55 kilograms of feed. The value of one eighth of a hectare pasture having 45 per cent camote stand, therefore, is equivalent to 180.55 kilograms in concentrate value. Had the stand been 100 per cent, its equivalent concentrate value would have been about 400 kilograms, which, if used to supplement the ration used in this experiment for the same class of pigs, is sufficient to make a gain of 116.6 kilograms of live weight pork. Basing calculations on the market prices of the corn, rice bran, and copra meal used to form the concentrate ration, the camote pasture saved ₱12.45 worth of feeds in lot I.

*Experiment III*

*Objects.* To determine the relative value of camote soilage and camote pasture for weanling pigs.

*Plan.* Ten male pigs were divided into two lots. Lot I was designated as pasture lot and placed in a camote pasture having an area of 625 square meters, and lot II as soilage lot was placed in a dry lot with an area of 150 square meters.

*Ration.* The basal ration consisted of the following:

| | |
|---|---|
| Corn | 8 parts |
| Rice bran | 8 parts |
| Copra meal | 4 parts |
| Shrimps | 1 part |
| Molasses | In small amounts to flavor |

To this ration was added one per cent of the mineral mixture.

Lot II received in addition about 5 kilograms of camote vines daily.

*Observations.* In general, pigs in lot I showed that they were thrifty and growthy and, by all indications, were developing, while the pigs in lot II were slightly smaller, but appeared more mature and finished than those of lot I.

Table 3 shows that the pasture lot gained 19.9 kilograms more than the soilage lot. The pigs on pasture gained faster than those on soilage. Lot I on soilage required 173.67 kilograms more concentrate to make 100 kilograms gain than was required by lot II on pasture.

The detailed results are shown in table 3.

TABLE 3

*Showing the computed results of experiment III*

| | LOT I | LOT II |
|---|---|---|
| | Camote pasture with corn, rice bran, copra meal, and shrimps | Camote soilage with corn, rice bran, copra meal, molasses, and shrimps |
| Number of pigs | 5 | 5 |
| Duration of experiment | 70 days | 70 days |
| Total initial weight | 70.60 kgm. | 68.20 kgm. |
| Total final weight | 128.20 kgm. | 105.90 kgm. |
| Total gain | 57.60 kgm. | 37.70 kgm. |
| Concentrates consumed | 207.02 kgm. | 200.97 kgm. |
| Corn | 70.86 kgm. | 68.56 kgm. |
| Copra meal | 35.43 kgm. | 34.28 kgm. |
| Rice bran | 70.86 kgm. | 68.56 kgm. |
| Shrimps | 8.87 kgm. | 8.57 kgm. |
| Molasses | 21.00 kgm. | 21.00 kgm. |
| Camote vines | ——— | 360.00 kgm. |
| Cost of concentrates consumed | ₱15.94 | ₱15.31 |
| Concentrate consumed per kgm. gain | 3.59 kgm. | 5.33 kgm. |
| Concentrate consumed per 100 kgm. gain | 359.41 kgm. | 533.08 kgm. |
| Cost of concentrate per kgm. gain | ₱ 0.28 | ₱ 0.41 |
| Cost of concentrate per 100 kgm. gain | ₱27.67 | ₱40.61 |
| Concentrate equivalent value of camote pasture | 100.24 kgm. | ——— |
| Cash value of camote pasture at average cost of concentrate....₱0.069 | ₱ 6.92 | ——— |

To make one kilogram of gain took 3.59 kilograms of concentrate in the pasture lot and 5.33 kilograms in the soilage lot, a difference of 1.74 kilograms in favor of the pasture lot. The cost of the concentrate feed used per kilogram gain was less by 13 centavos in the pasture lot.

## Summary

These experiments are preliminary in nature and the results obtained are presented to show the relative merits of camote pasture as compared with camote soilage, dry lots, and grassy lots growing only wild grasses, rather than to determine its exact equivalent value. The figures given should therefore be considered as only rough approximations of the true value of camote pasture. The reasons why they cannot be considered very accurate is that some of the pigs used died soon after the experiment and it is not likely that they were very normal during the period of observation. In all cases, however, both lots were treated similarly and no favor was shown any particular group.

Summarizing the results obtained, it is found:

1. That pigs on grass pastures did considerably better when given camote vines in the form of soilage in addition to the concentrate allowance.

2. That pigs on camote pasture with a concentrate allowance made more rapid gains than pigs on common grass (*Paspalum dilatatum*) pasture, receiving an identical concentrate ration.

3. That pigs on camote pasture fed a concentrate ration gained faster and more economically than pigs on dry lot receiving an identical concentrate allowance and camote vines in the form of soilage.

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# PUBLISHED CONTRIBUTIONS OF THE COLLEGE OF AGRICULTURE: IV[1]

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The "every-man-alive" character of the staff of the College of Agriculture is again well demonstrated in the intellectual output of published results for the past year. The spirit of inquiry permeates not only the entire faculty, but is also a constant inspiration to the student body as well. The most interesting and inspiring teachers who become real leaders of students are exactly those who are intellectually most alive and who are personally engaged in the immensely stimulating work of extending the boundaries of human thought and knowledge. Teachers cannot arouse or pass on inspirations and enthusiasms which do not burn in living fire in their own souls. I have had innumerable occasions to observe that students living and working in this atmosphere have no lack of sustained interest in their College work, and the onward march through their college courses becomes one of more and more intense interest in all lines of work affecting the development of agriculture in the Philippines and affecting the lives and interests of the Filipino people.

Every item of this output also means direct strengthening, amplifying, and focussing of the application, of the various courses now being given in the College, so that this all indicates with great clarity a tremendous growth within the College—a growth of vastly greater importance to this country than the erection of ornate buildings or development of material equipment, though these latter things have their place. The fact remains that the most important element of all is that of *men* and the minds within them, and we may well come down to the old definition of a real university as being in its simplest and most successful terms, "Mark Hopkins on one end of a log and a student on the other".

## II: EXPERIMENT STATION CONTRIBUTIONS

The contributions are numbered serially as reported. For Nos. 1–199, *see* THE PHILIPPINE AGRICULTURIST XII, No. 7, December, 1923. For Nos. 200–287, *see* THE PHILIPPINE AGRICULTURIST XIII, No. 10, March,

[1]General contribution from the College of Agriculture No. 182.

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(173) Uichanco, L. B. 1926. Note on Baker's study on "Some Lophopidæ". The Philippine Agriculturist **15**: 169.

(174) Fronda, F. M. Consider the humble egg. Philippines Free Press, August 7, 1926. *Chart 1.*

(175) Pendleton, Robert L. 1926. Subsidizing research ability. The Philippine Agriculturist **15**: 323–325. *Fig. 1.*

(176) Ocfemia, G. O. 1926. A review: "Citrus diseases and their control". The Philippine Agriculturist **15**: 385.

(177) Baker, Charles Fuller. 1926. Far Eastern representatives at the International Botanical Congress. The Philippine Agriculturist **15**: 401–402. *Frontis piece.*

(178) Baker, C. F. 1927. The great typhoon, November 5–6. The Philippine Agriculturist **15**: 463–465. *Pl. 1–2; fig. 1–2.*

(179) Villegas, Valente. 1927. A Review: "A manual of tropical plant breeding." The Philippine Agriculturist **15**: 491.

(180) Gonzalez, B. M. 1927. Education and agricultural promotion in Japan: I. Third Pan-Pacific Congress. The Philippine Agriculturist **15**:.

(181) Gonzalez, B. M. 1927. Education and agricultural promotion in Japan: II. Japan's system of education. The Philippine Agriculturist **15**: 571–577.

(182) Baker, Charles Fuller. 1927. Published contributions of the College of Agriculture: IV. The Philippine Agriculturist **15**: 615–620.

(183) Pendleton, Robert L. 1927. Standing on their own feet. Sugar News **8**: 30–33.

(184) Yule, Emma Sarepta. 1926. Stories from Japanese history. vii+248 p., 40 fig. Boston; D. C. Heath and Company. (A book.)

## IV. CIRCULARS

The circulars are numbered serially as reported. For Nos. 1–5 *see* The Philippine Agriculturist, XIV, No. 10, March, 1926.

No. 6. Gonzalez, B. M., and A. F. Taleon. (Compilers.) 1926. (Mimeographed.) Conversion tables for common Philippine weights and measures including metric and English equivalents.

No. 7. Mendiola, Nemesio B. 1926. (Mimeographed.) How to produce new varieties of gumamela (Hibiscus).

No. 8. Villegas, Valente. 1926. Horse breeding in the Philippines. (See Experiment Station contribution No. 306.)

No. 9. Gonzalez, B. M., and J. P. Esguerra. 1926. Fences for farm animals. (See Experiment Station contribution No. 332).

No. 10. David, Pedro A. 1926. (Mimeographed.) (*Revised by Charles Fuller Baker, Dean, College of Agriculture*). Practical directions for coffee planting.

No. 11. Anonymous. 1926. The New College Copra Drier. (*Prepared in Department of Agricultural Chemistry with co-operation of Departments of Agronomy and Extension.*)

## REVIEW: "INSECTS OF WESTERN NORTH AMERICA."[1]

This epoch marking book sets a new pace in entomological manuals. The field of entomological science is one of the most extensive of all biological sciences, due to the enormous number of species concerned (more than in all other animal groups put together) and to the infinite variety in structure, habits, and relationships. The ordinary student finds difficulty in getting any comprehensive conception of the field as a whole. In this book Professor Essig of the University of California has attempted the colossal task of building up a treatment of the economic and conspicuous insects of Western America, on a systematic and synoptical arrangement of the West American insects as a whole. As a first attempt for this great region, the book is a monumental success. The arrangement of its material is a triumph of book making. Its wealth of illustrations (largely original) vastly increases its interest, and this will stimulate its use by students. It is hoped that as knowledge of the subject grows this great work will continue to grow with it, in subsequent editions. In the meantime the synoptical treatment and wealth of material in the economic phases, will make it a standard reference work for students as well as specialists throughout the world.

Its dedication reads "To My Teachers and Friends, Dean Charles Fuller Baker and the late Doctor Albert John Cook."

[1]Essig, E. O. 1926. Insects of Western North America. 1035 p. 766 fig. New York: The Macmillan Company.

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Some—indeed very few—are born men of science. Others achieve such a vocation; only they must be helped to it. Scientific genius appears where and when it pleases. Nature is not prodigal of wonders like an Archimedes, a Newton, an Einstein. All we can do is to look up to them as they shine and to give them any means of work they may want.

—L. Levy-Bruhl.

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On the great clock of time there is but one word: Now!

—*Shakespeare.*

## ABSTRACT[2]

**Some factors affecting the growth of alfalfa in the Philippines.** Federico Goseco. (*Thesis presented for graduation, 1925, from the College of Agriculture, No. 248; Experiment Station contribution, No. 435*). In a series of four experiments the author made a study on: (1) the effect of fertilizers on alfalfa; (2) the effect of lime; (3) the effect of inoculation; (4) the effect of drainage; (5) the effect of planting alfalfa at different times of the year. The work was conducted during the year 1924–1925 in the Forage Crop Field of the College. These experiments were as follows: I, twelve kerosene cans, three of them checks, in which were planted alfalfa, were treated with fertilizer and lime. One can received lime alone and the other eight were treated with fertilizer in combination with lime. II, the same treatment as I with seeds inoculated with alfalfa bacteria. III, six cans provided with perfect drainage but not fertilized, and with seeds inoculated. IV, in the field culture each plot was fertilized and planted each month to determine the effect of season. Seeds used in these experiments were of Peruvian variety and the bacteria used were procured from United States Department of Agriculture.

Results of these experiments were as follows: The first crop was harvested four months after planting. Experiment I which was not inoculated bore no flowers. Yield and stand of the crop were inferior to experiment I. Plants responded much more readily to phosphoric acid than to either nitrogen or potash. Lime with phosphoric acid gave the highest yield. Experiment II bore flowers and produced nodules. Increase in yield was especially evident in the can that received a complete fertilizer. The yield was higher than in experiment I. Experiment III showed that well-drained cans yielded higher than the fertilized can in experiment II. Experiment IV showed that November planting gave the heaviest yield and June gave the lightest. The factors favorable for November planting are uniform distribution of rainfall, low temperature (24.1°C.) and less attack of insect pests.

In connection with these experiments, the relative productivity of two varieties, Peruvian and Kansas, planted at a distance of 25 by 25 centimeters, was determined. After a period of five months the crop was harvested. The yield was favorable for the Peruvian variety. For seed production the author found that the presence of insect pollinizers and trippers are necessary. The insects, *Nomia quadrifociata* and *Megachile philippinensis*, are the common pollinizers of alfalfa.

—*Abstract by Marcelo V. Arnaldo.*

[2]Abstract prepared as part of required work in English 6, College of Agriculture.

## EXCHANGE NOTES

Ducks have proven much more effective mosquito destroyers than fishes. In the experiments reported by Dr. S. G. Dixon, of Pennsylvania, two ponds, of 1,400 square feet each, were produced by dams on one stream, and 20 Mallard ducks were placed in one, while the other was well stocked with gold fish. For several months the duck's pond was entirely free from mosquitoes, which continued very abundant in the young stages in the other pond. The infested pond was then opened to 10 Mallard ducks, which first destroyed the tadpoles, and then ravenously devoured the mosquitoes in preference to any other food. In 24 hours no pupae could be found, while after 48 hours only a few larvæ survived.—(*From an old Journal.*)

---

(Young Muscovy ducks effectually keep ponds and water holes clear of Mosquitoes, but with us they do not eat the tadpoles (young frogs) which would form a taste for them.—Ed.)

—*Agricultural Society* (Jamaica.)

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On August 1st, 1890, the first Arbor Day was held in South Australia. It has now become a fixed function in the schools, providing a means of interesting the children in tree culture.

The usual custom is to plant native trees, and it will no doubt remain so, but a departure, which at once opens up possibilities in conjunction with the elementary agriculture now being taught in the schools, is the substitution of fruit trees for the native trees.

This has been done this year by several of the schools in the South East. On June 4th, the Glenburnie School initiated the movement, and was closely followed by the Kalangadoo and Compton Schools.

The District Orchard Instructor (Mr. H. H. Orchard), in response to the requests of the School Committee, had charge of the proceedings. Following a brief address by the Headmaster on "Arbor Day," an address on the selection of the fruit trees and the theory of pruning the young tree, illustrated by blackboard diagrams, was given by the Instructor. Then adjourning to the area where the holes had been prepared beforehand, the correct planting with the aid of the planting-board was demonstrated. The balance of the trees were planted by the children under the supervision of the Instructor, and a similar procedure was adopted with the pruning.

From time to time it is intended to use these trees to demonstrate various orchard practices to the children.

On every occasion the presence of members of the School Committee added interest to the proceedings, and was no doubt a source of encouragement to the children.

—*Journal of Agriculture* (South Australia).

* * * The boy who has raised a ton litter of pigs or nursed a prize field of corn to maturity will never be satisfied to sit on a stool eight hours a day and add figures in a ledger. The lure of the typewriter does not appeal to the farm girl whose chickens have won the blue ribbon.

—*The Prairie Farmer* (Illinois).

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It is not suggested that goats, either milch or Angora, should take the place of sheep or cattle, but that they would prove very profitable if run in conjunction, or on land and under conditions where it is not at present practicable or profitable to run other stock. On rough scrub country, as weed destroyers, and in the interior, goats prove their merit in a capacity which other stock are unable to do.

For suburban or country town residents who desire to have their own source of milk supply, goats will be found to fill that need, especially when conditions will not allow of a cow being kept. Goats can be tethered where desired, and so it is not necessary to have the land fenced, but water would be provided and a large box for shelter from wind, rain, and the sun. In this way they can be used to clean the ground as needed, there would be very little food wasted, and no risk of the animal becoming a nuisance to neighbours. The value of the milk will more than pay the cost of feed and attention needed.—E. F. Lane, at the State Conference of the Agricultural Bureau.

—*Agricultural Gazettee* (New South Wales).

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The soybean acreage of Illinois has shown a remarkable increase during the past five years. Much of the credit for this increase is due to a group of enthusiastic growers in Champaign and Piatt counties. They have experimented with varieties, with cultural methods, and with different ways of harvesting the crop. They have grown soybeans for hay and for seed and for oil.

The more they have learned about the crop, the more these pioneer growers have come to believe that it is destined to gain a permanent place in corn belt rotations. Soybeans are particularly valuable as a substitute for oats.

—*The Prairie Farmer* (Illinois).

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* * * The way to get international coöperation is to coöperate, and this is only possible in a spirit of amity. Furthermore, all solutions for our problems depend on wisdom, which is the product of organized knowledge. Such wisdom may come from any quarter, and science cares nothing for official sanctions. In the spirit of science, discussion is free, and each man desires to impart what he knows instead of concealing it from motives of "policy".

—*The Scientific Monthly.*

## COLLEGE AND ALUMNI NOTES

*Sugar News*, published in Manila, is the organ of the Philippine Sugar industry. According to its custom, each issue features the portrait and biography of some outstanding person in the local sugar industry or its related activities. The January, 1927, number of *Sugar News* is dedicated to our Dean. We think this a well-deserved compliment. Below a reproduction of his latest photograph appears the following outline of his active life:

*Dean Charles Fuller Baker*

Charles Fuller Baker was born in Lansing, Michigan, March, 1872. He was educated at the Michigan Agricultural College from which he obtained his degree of Bachelor of Science in 1891. Later he took a post graduate course at the Leland Stanford University obtaining his Master of Arts degree in 1903.

Dean Baker has devoted thirty-five years of service for the benefit and advancement of agriculture in general. He has taught for many years in various agricultural colleges and universities in the United States, and has seen service in Cuba, Nicaragua, Columbia, Brazil, and Malaya, where he conducted many field agricultural expeditions and surveys.

As an author there are many papers on botanical, entomological, and tropical agricultural subjects to his credit. He is a member of many technical and scientific societies, such as: the American Association for the Advancement of Science; American Association Econ. Entom.; Entom. Society America; Entom. Society Washington; New York Entomological Society; Southern California Academy of Science; Havana Academy Sciences; Soc. Linn. Lyon; Soc. Ent. France; Soc. Ent. Italiana; Deutsche Ent. Geschellsch.; and Soc. Ent. Belgique.

Since 1919 he has been Dean and Professor of Tropical Agriculture, College of Agriculture, University of the Philippines, and Director of the Experiment Station. The development of the Los Baños Agricultural College to its present standing has been due greatly to his energetic leadership. As dean of the College of Agriculture, he has rendered a great service to the Philippine sugar industry through the beneficial cooperation which the College has extended and is extending to the industry in the solution of its many problems.

Dean Baker has recently been granted leave for one year by the Board of Regents of the University of the Philippines. The *Sugar News* and his many other friends wish him an enjoyable vacation and an early return to these shores.

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Mr. Hidrosollo, Director of the Bureau of Non-Christian Tribes, and recently appointed member of the Board of Regents of the University, as chairman of the Board committee on agriculture visited the College January 5 to study first hand certain proposed projects for the College. He was accompanied by Governor Gutierrez of Cotabato, who was enthusiastic in his expression of gratification at the healthy growth of the College since he last saw it.

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In the *Proceedings of the Fourth Annual Convention of Philippine Sugar Association* we note that Doctor Roxas and Doctor Pendleton from this

College took active part in the discussions. Doctor Roxas presided in the sessions in which "Cane Varieties, Disease, and Fertilizers" were the topics for discussion. The following is quoted from "Experimental Work" in the *Proceedings:*

For the purpose of correlating the results of the field experiments with the soil conditions, the Philippine Sugar Association has engaged the services of Dr. Robert L. Pendleton, Professor of Soil Technology of the College of Agriculture, Los Baños, to make a soil survey of the various sugar districts in Negros. Dr. Pendleton made an extensive soil survey of Negros in April and May of this year, and the tracings, maps and classifications of the various types of soils surveyed are in course of preparation. When completed, these will be distributed among the members of the Association for their information.

---

Remarks in letters on Mendiola's "A Manual of Plant Breeding for the Tropics": From Prof. David L. Crawford, University of Hawaii, Honolulu:

Our Plant Breeding Department has ordered a copy of this book and until this arrives I have loaned my copy to that department. Professor Krauss has looked it over and speaks very highly of it as being a work of great merit.

From Mons. Paul Serre, Consul of France, Auckland, New Zealand:

Dr. Mendiola has made a name for himself in the scientific world. To begin with, I shall write an article on it for the Institute of Colonial Agronomy and the Academy of Agriculture of France. I regret that Dr. Mendiola had not seen my book, "Le Tabac de Cuba et les Cigares de la Havane (1911)—Agustin Challanel, publisher, 17 rue Jacob, Paris."

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Two weeks of the Christmas vacation were used by Dr. Robert L. Pendleton in making a study of certain of the soils and agricultural conditions of the Calamba Sugar Estate, Canlubang, Laguna Province. A detailed soil survey of certain fields has been made, and a large number of samples have been collected for study in the laboratory. Three thesis students of the Soils Division—Alfonso Briones, Charoon Suebsaeng, and Roem Purnariksha—also assisted in the field work, getting material for use in their thesis work.

---

The January number of *The Makiling Echo*, the quarterly publication of the School of Forestry, offers an unusual number of articles of interest.

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On the editorial page of the November number of *California Cultivator* appears under the caption "Philippine Agriculture" an excerpt from "Our Agricultural Policy should Center on the Food Supply", by Toribio Vibar, the editorial in THE PHILIPPINE AGRICULTURIST, July, 1926.

"Value to Farming of Philippine Soil Surveys" by Dr. Robert L. Pendleton of the Soils Division appeared in the December number of *The American Chamber of Commerce Journal.*

In the same journal there is a brief, forceful article on "Well-being and Happiness for the Average Filipino Farmer," signed "Extension Division, College of Agriculture." An extract from *Siam* on the efforts of the Government of Siam to encourage foreign capital carries this note:

Dean Baker of the college of agriculture, sending the above to the *Journal*, says: "This is remarkably significant when it is remembered that through the years Siam was gradually dismembered and robbed of territory by France and England and might have justly feared incursion of foreign capital. Quite to the contrary, foreign capital stabilized and crystallized her political status and hastened the definition of permanent boundaries."—Ed.

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A letter to Dean Baker from the Division of Commerce, Buitenzorg, Java, contains the following:

Having come across a specimen number of your periodical "The Philippine Agriculturist" I was much interested in its contents and wonder whether you would agree in affording us a free subscription for the coming year in exchange for the following publications:

Report on commerce, industry and agriculture, 1925.

A series of booklets dealing on the different products of the Dutch East Indies, recently issued by this division.

This office is willing to provide your readers with more detailed information on request while the photographs besides other charts and graphs are available for your use if this might convenience you.

---

Professor Gonzalez, delegate to the Third Pan-Pacific Science Congress, brought from Japan thirty eggs of Nagoya breed of chickens. This is the common fowl of Japan. It is buff in color, considerably larger than the Philippine chicken, and is noted for its hardiness. The eggs were presented to him by the Imperial Zootechnical Experiment Station of Japan through its Director, Dr. K. Kimura. Doctor Fronda reports a hatch of fourteen vigorous chicks. So far as known this is the first attempt to introduce this breed into the Islands. It will be studied thoroughly for its possibilities in the Philippines as egg and meat producer, pure and graded with the Cantonese. The eggs were kept in the ship's vegetable refrigerator while en route.

---

Letters with Christmas and New Year's greetings were received by some faculty members from Mr. Thongdee Resanant, B. S. '24. Mr. Resanant is now teaching in the Agricultural Teacher's Training School at Tap Amang Station, Korat Line, Siam. He expressed regret that the school had not been going ahead rapidly owing to lack of funds. Things look better now "due to changes both in the head of the administration and kingship." Mr. Resanant states that the Crown Prince, who visited our College last semester, had words of praise for this institution.

A letter to Dean Baker from Mr. N. W. Sinclair, Manager, Mindoro Sugar Company, San José, has the following to say about one of our graduates, Mr. Pablo Quizon, B. Agr. '25.

Mr. Quizon is taking a leave of absence and, while in Luzon, plans to visit you with a view to explaining the nature and scope of his work with us in connection with our organized campaign of Rat Poisoning which promises much in saving a considerable portion of our crops.

It is a pleasure to state that Mr. Quizon has shown unusual originality in adapting the Hawaiian Poisoning plan to meet with local Philippine conditions and we know that you will be proud to hear that one of your graduates has embarked in a work of such possibilities and one which assures him of unusual opportunity to make a worth while reputation for himself in the business as well as in the sugar world.

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The twenty-fourth scientific meeting of the Los Baños Biological Club was held on December 16, 1926, at 7:30 p. m. in the College of Agriculture Auditorium.

The following papers were read and discussed: Mr. Pedro A. Rodrigo —"Production of peanuts from cuttings." Dr. Bienvenido M. Gonzalez —"Observation on education and research in Japan—agricultural and general (with lantern slide illustrations)."

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The annual Christmas Party given by the faculties of the Associated Colleges at Los Baños to the students remaining on the Campus during the holidays was given in the New Mess Hall, December 24. It was an afternoon and early evening affair. Under Mr. Dawis' skillful hands the dining hall was gay in red and green with several Christmas bells. A real pine Christmas tree from Baguio gave the finishing touch. In the afternoon there was dancing. The rigadon was revived with much merriment. After the buffet supper, the following program was given:

1. Welcome - - - - *Mr. Tongko, "Y" Secretary*
2. A Christmas Message - - - - - *Dean Baker*
3. "The First Christmas, according to St. Luke" - - - - *Miss Adaline Pendleton*
4. "Souvenir"—Violin Solo - - - *Mr. V. Kilayko*
5. "The First Christmas Tree", by Henry Van Dyke - - - - - - *Miss Emma S. Yule*
6. Christmas Pantomime to Music - - *All Star Cast*
7. Singing of Christmas Carols - - - - - *All*

The pantomime arranged and directed by Miss Wilson, of the English Department, gave in three episodes the old, old story of Bethlehem. During each episode a chorus sang softly appropriate hymns and carols, closing the beautiful pictures with "Silent Night" sung by Mrs. Pendleton, Doctor Pendleton's mother.

Much credit is due Mr. Villaluz for the artistic scenic background for the pantomime. Professor Roa with selections on the piano and his enthusiastic leading in the carol singing did much to give the party a real Christmas tone.

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*New Pledges for the College of Agriculture Alumni Hall*

| | | |
|---|---|---|
| Total brought forward | ₱2,000.00 | |
| Teofilo F. Novero, '22 | 25.00 | |
| Emilio C. Aquino, '23 | 50.00 | |
| Baltazar Corcino, '22 | 6.00 | |
| Julian Morada, '20 | 50.00 | |
| Gil O. Opiana, '23 | 25.00 | (additional) |
| Joaquin J. Gonzalez, '19 | 200.00 | |
| Miguel A. Ortiz, '25 | 50.00 | |
| Eutiquio Q. Zulaybar, '14 | 50.00 | |
| Francisco A. Abadilla, '17 | 80.00 | |
| Total to date | ₱2,636.00 | |

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*New books added to the Library, College of Agriculture, from December 1 to 30, 1926.*

Association of Official Seed Analysts.
Proceedings of the Association of Official Seed Analysts.

Beebe, W.
Jungle days. 1925.

Bishop, J. B. (ed.)
Theodore Roosevelt's letters to his children. 1926.

Bradbury, F.
Carpet manufacture. 1904.

Charabot, E.
Les productions végétales des colonies Françaises. 1908.

Coolidge, C.
The price of freedom; speeches and addresses. 1925.

Eichler, L.
Well-bred English. 1926.

Franklin, F.
Plain talks on economics. 1924.

Gage, H. S.
The microscope. 1925.

Hildebrand, A. S.
Blue water. 1923.

Kieffer, J. J.
Das tierreich-eine zusanmens-tellung und kennzeichningder rezenten tierformen. 1926.

Mills, D.
The book of the ancient world for younger readers. 1923.

Murasaki, Lady.
The tale of Genji. 1926.

Nitobe, I.
The Japanese nation, its land, its people, and its life with special consideration to its relation with U. S. 1912.
Nitobe, I.
Bushido, the soul of Japan. 1905.
Poultry Science, Vols. 1–2 and 3–4. 1921.
Russell, C. E.
The outlook for the Philippines. 1922.
Russell, C. E., and Rodriguez, B. E.
The hero of the Filipinos. 1923.
Rhys & Dawson, Scott (editors)
Twenty-nine love stories, old and new. 1925.
Revised administrative code of the P. I. of 1917. 1926.
Sabin, E. L.
Pluck on the long trail or boy scouts in the rockies. 1912.
Sorauer, P.
Handbuch der pflanzenkrankchiten. 1925.
Taussig, F. W.
The tariff history of the United States. 1923.
Thirty-third annual report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institute. 1919.
Tolstoi, Leo.
Anna Karenina. Vols. 1 and 2. 1926.

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